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WORLD SWORDFISH FISHERIES

Volume IV.

Latin America

Part A. South America

Section 1. Pacific

Segment A. Colombia, Ecuador, and Peru

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

WORLD SWORDFISH FISHERIES

An Analysis of Swordfish Fisheries, Market Trends, and Trade Patterns
Past-Present-Future

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Volume IV.

Latin America

Part A. South America

Section 1. Pacific

Segment A. Colombia, Ecuador and Peru

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The Office of Science and Technology

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Silver Spring, Maryland

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PREFACE

The waters off Latin America, especially South America, are major world fishing grounds. Fishermen conduct fisheries both to produce fishmeal and edible products. Two countries (Chile and Peru) routinely report some of the world's largest fishery catches. The Peruvian catch has approached as much as 13 million tons. This massive catch is composed largely of small pelagic species (anchovy, jack mackerel, and sardines) which are reduced to relatively low-value fishmeal. Until the 1970s Latin American fisheries for edible species were primarily artisanal operations employing traditional methods and in many cases operating at near subsistence levels or producing non-export grade product sold for minimal prices on local markets. Until recently there was a relatively weak demand for seafood in much of Latin America, especially in the inland cities where the region's population has traditionally been centered. Most consumers showed a preference for red meat. In part this was due to the generally poor quality of the available product. Inadequate handling and processing standards meant that the fish available to consumers beyond coastal cities was often poor quality product. Most of the countries in the region are gradually modernizing their fisheries. The first modern commercial fisheries were often shrimp trawl fisheries which began to appear in the 1950s. Generally the first commercial fisheries to develop were those aimed at export markets because of the greater availability of funds for needed investments in vessels, gear and processing plants. Fishermen have gradually developed many other commercial and artisanal fisheries deploying a wide variety of gear and methods as well as new aquaculture industries. Many companies in the region now produce high-quality product meeting international standards and market it in both domestic and export markets.

The development of modern commercial and improved artisanal fisheries in Latin America has many economic and commercial implications. The evolving Latin American fishing industries offer opportunities for U.S. shipyards, manufacturers (gear, electronic instruments, and processing equipment), consultants, fishermen, brokers, investors, etc. The information in this report may be of interest to those U.S. companies trying to access market opportunities in Latin America. Fisheries used to be an economic backwater in much of region. That has changed over the past two decades. Many countries in the region now list fishery products as one of their principal export commodities, remarkable considering the fact that there was virtually no commercial development before the 1950s. In many countries the fishing industry is now one of the most dynamically growing sectors of the national economy. The industry is creating well-paying jobs, producing food, and increasing export earnings. Several countries have resources that are not yet fully utilized and could permit continued expansion. Many countries report, however, greatly expanded fishing effort and declining yields. Government that just a few years ago were promoting the industry's development are now faced with the need to limit that effort to ensure optimal utilization.

Available fishing fleet and catch data graphically show that Latin American fishermen are steadily expanding the fishing industry. Much of the effort has gone into purse seine fisheries for small and large pelagics and trawl fisheries for shrimp and groundfish. Some countries are making enormous progress with aquaculture. A wide variety of other gear and methods are being used on a smaller scale. Some fishermen are using gillnets and driftnets to catch a diverse range of species, including oceanic pelagics like tuna and swordfish. Much of the Latin American effort on oceanic pelagics has focused on tunas and several countries have developed important fisheries (Brazil, Colombia, Ecuador, Mexico, and Venezuela).

Less attention has been devoted to the smaller swordfish resources. The first Latin American swordfish fisheries (Chile and Peru) in the 1940s and early 50s were at the time some of the most significant fishery operations in the region and for a few years dominated the local fishery. Since the 1950s, the species off Latin America was fished almost exclusively by foreign fishermen conducting longline operations on the highseas and to a lesser extent through a variety of access arrangements in coastal waters. Foreign fishermen have been active off both the region's Atlantic and Pacific coasts. Latin American fishermen, with the exception of Cuba, did not begin to target the species themselves until the mid-1980s with the deployment of both driftnet (Chile and Mexico) and longline (Brazil, Chile, Costa Rica, Ecuador, Uruguay, and Venezuela) fisheries. Foreign fishermen and vessels have played a major role in the longline fisheries in several of these countries (Brazil, Chile, Cuba, and Uruguay).

The high value available for swordfish has meant that it is an attractive species for both local and distant-water fishermen. The efficiency of modern fishing gear, however, has also meant that valuable species, like swordfish, are often heavily targeted.

This is certainly case of swordfish and the massive effort deployed and declining yields has prompted Atlantic-coast countries to restrict fishing effort in the north Atlantic through the International Commission for the Conservation of Atlantic Tunas (ICCAT) to bring the north Atlantic effort in line with the available resource. Two Latin American countries (Cuba and Venezuela) are especially concerned with north Atlantic swordfish.

Foreign fishermen have responded by significantly shifting effort into the south Atlantic. The Spanish in particular have greatly expanded their swordfish catches in the south Atlantic, reporting larger catches than the two principal South American countries involved (Brazil and Uruguay). ICCAT has, as a result, implemented a management scheme for the south Atlantic. The expanded foreign fishing in the south Atlantic is of special concern to two Latin American countries (Brazil and Uruguay).

Observers are now concerned about expanding fishing and falling yields in the Pacific. The major Latin American fishing country in the Pacific is Chile. Chilean fishermen have, however, reported a massive catch decline since the fishery peaked in 1991. Other Pacific-coast Latin American countries have smaller fisheries (Costa Rica, Ecuador, and Mexico). Several countries (Colombia and Peru) are assessing possible tuna/swordfish longline fisheries. The international community has given less attention to Pacific swordfish then Atlantic swordfish, but several international organizations are conferring increased attention on the species. Scientists have held symposia focusing specifically on Pacific swordfish. The bulk of the fishing in the Pacific have been conducted by a small number of distant-water countries (Japan, Taiwan, and the United States). Latin American countries are focusing increasing attention on swordfish, responding to the strong demand in international markets for high-quality fresh product.

Latin American fishing effort on Pacific swordfish has declined somewhat since 1991 because of the decline of the Chilean fishery. Some countries (Costa Rica and Ecuador) which are developing longline fisheries, however, have reported improved catches. Several other countries (Colombia, Peru, and Mexico) are considering the deployment of longline fisheries. It would thus appear likely that Latin American fishing effort will increase in the next few years. The overall trends will be significantly affected by developments in Chile which has the largest commercial longline fishery and could significantly increase effort in both coastal and offshore grounds, if warranted by market conditions. Currently much of the country's longline fleet is deployed in bottom longline fisheries for demersal species because of favorable prices for those species. Several of those vessels could be deployed on surface fisheries for swordfish and tunas, depending on market conditions. Developments in other countries are likely to be slower, but two countries (Costa Rica and Ecuador) reported substantial catch increases in 1996. In some instances the local fishery deploys relatively small vessels (Costa Rica and Ecuador) while in others (Colombia and Peru) large foreign commercial longliners have been contracted. Major expansion of domestic effort in these countries, however, will require substantial investment in new vessels as well as the acquisition of foreign technology. Costa Rica and Ecuador have demonstrated the possibility of expanding operations by promoting artisanal fishermen with modest investments. It is unclear, however, as to how many countries could pursue this option. Other countries which have tried to deploy commercial longliners through foreign joint ventures (Brazil, Peru, and Uruguay) are now giving increased attention to small coastal longliners.

The international community is currently addressing many difficult fishery issues, including high-seas fisheries, reflagging, straddling stocks, and responsible fishing. Increasingly world fishery managers are coming to the conclusion that effective management of fisheries requires expanded international cooperation. Talks are underway seeking to establish accepted international norms. These discussions have lead to some agreed international guidelines, but the complexity of the issues and the conflicting interests involved suggest that problems will persist for some time. One still unresolved issue, especially in the Pacific, is the problem of international management of a highly-migratory stock. It will not be an easy process to reach a consensus on swordfish. The data in this and accompanying regional surveys is designed to provide some basic information to the government officials assessing possible cooperative efforts.

Biologists from several countries are giving considerable attention to swordfish and other oceanic pelagics. For the most part, however, little research is being conducted in Latin America, primarily because the species has until recently been of little commercial interest in most countries. In addition, research on highly migratory species is often difficult and costly, usually with no immediate return. The Chilean Instituto de Fomento Pesquero (IFOP), however, has assigned considerable priority to its swordfish research program.

Biologists as a result of the expanding body of research are beginning to better understand basic data about the stock structure and behavior of Pacific swordfish. While researchers are just at the beginning stage of collecting data, they are acquiring the data needed to effectively manage the species in the Pacific. Much of the research underway has been initiated by Japan and the United States and centered on the north Pacific. Data on the south Pacific is much more limited. The authors have attempted to summarize the Latin American research efforts as well as other foreign work which may help in the understanding of the species in the southeastern Pacific.

Government officials are also concerned about the sometimes considerable by-catch associated with swordfish fisheries. Sharks are coming under increased fishing pressure and they are a major part of the by-catch in many tuna and swordfish fisheries, especially the coastal fisheries conducted in Latin America. Other by-catch concerns include seabirds, marine mammals, and billfish. Turtles are a special concern because of the precarious state of many species. Some environmentalists believe that the turtle by-catch from tuna/swordfish fisheries may be considerable. The incidence of interaction may be low, but given the heavy fishing effort, the overall impact could be significant. Biologists are especially concerned with the sharp drop in leatherback turtles and some believe that driftnet and longline fisheries in the southeastern Pacific may be a factor in the decline.

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September 24, 1997

ACKNOWLEDGMENTS

The Latin American section of this study focuses initially on the Pacific coast countries of South America. Planned future volumes will cover other Latin American countries. The next planned set is the Atlantic coast South American countries (Argentina north to Venezuela). The authors are indebted to the many contributors throughout the region who supplied information and guidance. The individuals named here are primarily those who contributed to the South American Pacific chapters. Those individuals who have contributed to the Atlantic coast studies will be acknowledged when those chapters are published.

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Various individuals from multilateral organizations, academic institutions, and U.S. companies were also extremely helpful to the authors. Assistance offered by the Fisheries Department of the Food and Agriculture Organization has proven crucial in obtaining up to date statistics. The authors are particularly indebted to **Adele Crispoldi** whose painstaking work compiling often hard to synthesize data is critical to the analysis of world fisheries. Without the work of Adele and her colleagues, the complication of this and previous works would have been virtually impossible. FAO provides an invaluable service to those of us involved in assessing international fisheries. We are most grateful to Adele for her unfailingly prompt and informative replies to our many queries. **Fabio Carocci** and **Jacek Majkowski**, FAO Fisheries Resources Division, published an informative atlas on tuna and billfish which proved helpful in efforts to assess seasonal patterns. They kindly assented to the reproduction of some of their graphics, but unfortunately technical problems prevented this. **Gabriel Rodríguez Marquez**, Officer in Charge of the FAO Office, in Montevideo helped organize appointments in Montevideo and provided much useful information on the local fishing industry and foreign activity. **Roland Wiefels**, Director of INFOPESCA, provided helpful Latin American trade data. **Martín Hall**, Inter-American Tropical Tuna Commission (IATTC), provided insightful data on purse seine by-catches in the eastern Pacific. **Michael Hinton**, another IATTC researcher, provided an overview of Pacific swordfish research. **Matthias Tomczak**, Flinders University of South Australia, and **J. Stuart Godfrey**, Commonwealth Science and Industry Research Organization, kindly permitted the use of some of their informative oceanographic maps. **Peter Redmayne**, Seafood Leader, provided a wonderful

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NOTES

The authors stress that this is not a scientific paper. The principal objective of the report is to provide and analyze timely statistical data for U.S. Government officials, company executives, consultants, academic institutions, and environmental groups, and others interested in Latin American fishery developments. The authors have sought to inform U.S. groups as to the full scope of opinions expressed in each country concerning the swordfish and other related fisheries. For this reason unverified press reports have been used extensively because they provide an indication of prevailing opinions and the range of ideas expressed in policy debates. A timely synthesis of available commercial, economic, and scientific information is needed to fully understand local fishing industries. The time required to prepare a thoroughly evaluated scientific paper would make the economic and commercial data in the report so dated that it would be of little value to U.S. readers, beyond marginal historical interest. The authors have decided instead to provide "snap shots" of selected countries giving the reader data as well as available opinions and projections on this rapidly evolving fishery. In some cases opinions have been presented that can not be substantiated by available data. A wide range of assessments are provided because the authors often do not have adequate data to determine who was correct. In other instances the authors have presented opinions with which they disagree to provide a full spectrum of thought from the region. U.S. businessmen and researchers working in Latin America, need to be aware of the full spectrum of views, even widely held opinions that may not be valid. Knowledge of the discussions currently underway and diversity of opinions among officials, researchers, and businessmen in the region is important to government officials and businessmen planning to work in the region.

The authors have chosen to provide detailed notes to each of the reports in this volume. The level of documentation is admittedly unusual for a Government or even academic paper. The authors have decided to make such elaborate citations for the following reasons:

Further research: Each country report, even the longer chapters, is only a superficial analysis of the local fishery. The references thus provide interested researchers a detailed account of sources which may prove useful in pursuing specific subjects on their own in greater detail.

Evaluation: The authors have often been unable to obtain hard data on specific subjects and countries. In many cases such data simply does not exist. In other cases local,officials are unwilling to release data. Often the authors had to rely on the opinions of local officials and industry leaders. The notes identify those sources to help the reader evaluate the specific statements.

Assessments: The authors have received many varied, and frequently conflicting, appraisals on the current situation from different local observers. In many instances, it was not possible to fully assess those appraisals. As a result, the authors have often presented a synthesis of different reports to give the reader an idea of the range of assessments.

Unpublished: Much of the information did not come from published sources, but rather from telephone conversations and personal interviews, usually in Spanish. As one of the authors is not a native Spanish speakers, this creates the possibility for some misunderstanding. Obtaining information over the phone is difficult enough even in English, the intricacies of a foreign language compound the difficulties. The authors, as a result, felt it important to identify the individual source and date much more thoroughly than if more detailed published information had been available. Each of the interviewees was provided a draft of the report to ensure that their comments were correctly noted.

The reader should not take the information on vessel lists, vessel imports, vessel construction, company catch and processing activities, joint ventures, and other matters as complete lists. While the authors attempt to follow announcements in fishery journals, many such developments are only reported in local newspapers which the authors can rarely obtain. Often such developments are not publicly reported at all. Thus the listings in this study are often incomplete and in many cases dated. While they can not be used as a complete inventory of such developments, they do provide a useful overview of the range and diversity of the activities involved, as well as a reasonably complete list of the established and major companies. The authors have not excluded specific companies, shipyards, joints ventures out of any policy decision, but rather because of the limited information available. In a few cases companies have declined to provide information or representatives asked that they not be cited. Individual companies that think their activities should have been mentioned in possible future assessments are encouraged to provide details on their operations to the authors.

The preparation of this report has been significantly impaired by the paucity of reliable

statistical and other published information. This is due to several factors:

New fishery: The swordfish fishery is relatively new, and in most instances conducted by artisanal fishermen or small companies. Effective industry trade groups exist in only a few countries and in most cases these groups have little interest in swordfish.

Limited statistical data: The Government agencies in many countries do not publish extensive fisheries data. This is particularly true for small, relatively minor species like swordfish in most countries. Several small countries have particularly limited data collection systems. It is not, however, just a function of the size of the country. Brazil in particular does not publish annual statistical reports. In addition, many countries have reduced data collection services during the 1980s as part of the overall economic retrenchment. Luckily for an assessment of Pacific swordfish, Chile does have an excellent statistical service and a great deal of data was available. Chilean researchers are expanding data a collection efforts, including catch data by fishing area.

Suspicion: Industry sources in some countries are reluctant to provide information. This is partially due to the concern that such data will be used by Government officials to enforce tax and exchange rate regulations and partly out of a general unwillingness to release information for public dissemination. This reluctance has been exacerbated by trade actions brought by U.S. environmental groups. Many businessmen are concerned with additional such actions in the future. Whatever the reason, their reluctance has made it difficult to obtain accurate information on the swordfish fishery in several countries.

Limited local assessment: General surveys of national swordfish fisheries, except in Chile, are rare. Few local observers have published detailed assessments synthesizing available scientific, commercial, economic, and social data.

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Personal Observations

Resource

"Swordfish are not abundant off Colombia, probably because of the high water temperatures and minimal impact of the cold Humboldt Current."
- Javier Betancourt, Manager, INPESCA (Colombia), February 20, 1997

"I would not conclude from the warm water temperatures and limited swordfish catches off Colombia that the fish are not present. It simply may be that current operations are not at the proper depth or time of the day to take the fish. Swordfish can be taken in relatively warm water."
- Freddy Arocha, Universidad de Oriente (Venezuela), July 7, 1997.

"The lack of cold water currents along the Ecuadorean coast limits swordfish abundance. As a result we have focused primarily on tuna. I have noticed, however, increasing interest with swordfish."
- Boris Buenaventura Trujillo, Manager, PESYMAR (Ecuador), February 8, 1997

"The waters off Cabo Blanco in northern Peru are a sport fisherman's paradise, the only place in the world where anglers can take both swordfish and black marlin--the largest game fish species."
- S. Kip Farrington, Jr., sport fisherman, 1953.

"We initiated commercial longlining for swordfish in mid-1997, the first Peruvian company to target swordfish with longlines. We have achieved moderately good catches off the southern coast, but very disappointing results off the northern coast. This could be due to the abnormally high temperatures associated with the 1997 El Niño."
- Ramon Salas, vessel captain, SIPESA (Peru), September 1, 1997

Development

"Ecuador has developed an efficient artisanal longline fishery, one of the most modern in Lain America. The fishermen are able to land high-quality product which meets the standards of U.S. importers. Our artisanal fishery is one of the few in Latin America with this capability."
- Boris Buenaventura, PESYMAR (Ecuador), May 15, 1996

"Ecuadorean fishermen are gradually expanding longline operations. These operations have been primarily artisanal, but our company deployed a commercial longliner for swordfish in 1996."
- Jorge Delger, Owner, Oro Marisco (Ecuador), May 24, 1996

"Exporters formed the Asociación de Exportadores de Pesca Blanca to identify and solve problems affecting the sector. For example, the association promotes cooperation between fishermen, brokers, and exporters so that all benefit and each receive a fair share of the revenue. In the past some unscrupulous brokers were exploiting the fishermen."
- Boris Buenaventura Trujillo, Director Ejecutivo, Asociación de Exportadors de Pescado Blanco (Ecuador), May 15, 1996

"I have tried for years now to initiate a tuna/swordfish longline fishery here in Peru. I arranged for the lease/purchase of modern Japanese longliners, but the Government's decision to change regulations forced me to cancel the project at huge cost. Such decisions to constantly change the 'rules of the game' is the major reason why our country has been unable to develop a modern fishery targeting these species."
- Máximo Collao, General Manager, Tuna Latin (Peru), August 4, 1997.

"Our fishermen have in recent years not targeted swordfish. This is probably due to the cost and advanced technology required to initiate this fishery. There are other available resources in coastal waters that can be developed at less cost and with technology more familiar to the fishermen."
- Albertina Ameya K., Director de Estudios Economicos y Evaluación de Recursos Potenciales, IMARPE (Peru),

August 14, 1997.

"We are one of Peru's largest fishing companies. It is still unclear to me why our longline venture failed, but we are currently assessing the experience to guide future projects."
- Javier Barendiran, Commercial Department, Grupo Sotomayor (Peru), June 11, 1997.

"We have deployed three coastal longliners to target swordfish, the first Peruvian company to do so. We have decided to use relatively small coastal longliners delivering iced fish rather than large freezer vessels. We believe this could prove to be a valuable new export fishery for Peru."
- Eduardo Pastor, SIPESA (Peru), September 26, 1997

Domestic Fishermen

"Our artisanal longline fleet primarily targets sharks, although catches have dropped substantially in recent years. Operations are coastal and swordfish are rarely taken."
- Javier Bentancourt, Manager, INPESCA (Colombia), February 20, 1997

"I have been working with the artisanal fishermen to promote surface longlining for pelagics. The fishermen, who have for years targeted demersal species, are very reluctant to shift, despite the good results we have demonstrated."
- Luis Manjares, INPA/VECEP (Colombia), February 24, 1997

"I participated in surface longline trials for large pelagics, but have decided to continue the traditional fishery targeting demersals. I'm still skeptical about the profitability of longlining large pelagics off Colombia."
- Juan Asís, boat captain (Colombia), February 24, 1997

"Our artisanal fishery is not developed like the Ecuadorean fishery which has speedy fiberglass "lanchas" allowing them to reach the grounds, catch the fish, and return to port with high-quality fresh fish for export. Our artisanal fishermen are clinging to more traditional handline operations and rarely deliver export grade product."
- Juan Valverde, INPA/VECEP (Colombia), February 24, 1997

"Our fleet has primarily targeted tuna with small swordfish by-catches in coastal waters. Some of our fishermen are now beginning to target swordfish in waters to the west of the Galápagos and reporting excellent results."
- Jorge Delger, Owner, Oro Marisco (Ecuador), May 24, 1996

"We have been concerned for some time about foreign longliners off the Galápagos and their potential to harm the fragile island ecosystem. Now our domestic fishermen are deploying longliners to the west of the Galápagos and landing tuna and swordfish in Santa Cruz. We are at this time studying a possible enforcement system and regulations for companies operating off the Galápagos."
- Alfredo Serrano Valladares, Diputado for Galápagos Province (Ecuador), May 23, 1997

Foreign Fishing

"Colombia has one of the largest licensing programs for foreign fishermen. Most of the vessels, however, are either purse seiners or shrimp trawlers. Only a few longliners are involved."
- Fernando Rey, Subdirector General, Desarrollo y Ordenamiento Pesquero, INPA (Colombia), March 11, 1996

"Our company works extensively with foreign longliners operating under licenses in Colombian waters. The major target species is tuna which is the great bulk of the catch, 80 percent or more. A by-catch of mostly shark, but also some marlin and sailfish is also reported. Swordfish by-catches are rare."Swordfish by-catches in Colombian waters are unusual."
- Roberto Osbina, Owner, Pescaderia Adsturiana (Colombia), March 24, 1997

"Jobs are available on the foreign longliners licensed for fishing operations. Many of our fishermen, however, are reluctant to work on the mostly Asian vessels. They appear to object to the working conditions and long voyages."
- Marta Lucia de Pava, Bahia Cupica (Colombia), February 26, 1997

"Many foreign longliners are active in the eastern tropical Pacific. In Ecuador we do not permit them to transship their catch through our ports. If they desire to operate in our waters, they need to obtain licenses. They must operate in association with Ecuadorean companies and hire Ecuadorean crew members. We believe that this system is important to introduce modern technology to our fishermen."
- Orlando Crespo, Dirección Nacional de Pesca (Ecuador), June 5, 1996

"The Spanish appear to be targeting grounds on the Nazca Ridge off Peru and Chile. They have been taking large quantities of juvenile swordfish there."
- Hans Louis Schmidt, Pesquera Omega (Chile), April 8, 1996

Markets

"The U.S. market is the major world market for swordfish and is the market we have targeted. Almost all of our swordfish is landed fresh and exported immediately to the United States as whole trunks."
- Otto Schwartz, Manager, MARDEX (Ecuador), May 16, 1996

"Like other companies we have primarily exported swordfish to the United States as fresh product. Our company in 1996 also began to process small quantities of fresh fillets for the U.S. market."
- Diego Franco, President, FRESMAR (Ecuador), May 23, 1996

Research

"We have not engaged in research on swordfish or other billfish because until recently the species was not targeted by our fishermen. As the longline fleet is now targeting these species, we are considering a research program to provide information to the fishermen and to serve as a basis for fisheries management."
- Cecilia Marín, Biologist, Instituto Nacional de Pesca (Ecuador), May 20, 1997

"Colombia has a limited fisheries research capability. Most of the work on marine fish is done by INPA, but very little research has been conducted on large pelagics like tuna and swordfish or other billfish. Now that Colombia has developed an important tuna fishery, more attention will be devoted to these species."
- Luis Alonzo Padilla, Coordinator of Marine Resource Evaluations, INPA/VECEP (Colombia), February 28, 1997

"IMARPE conducts extensive plankton tows to assess the anchovy and other small pelagic populations for our large fishmeal industry. We have never detected swordfish larvae in those tows. This is a good indication that the fish are not spawning in the eastern Pacific."
- Emira Antonietti, IMARPE (Peru), personal communications, March 24, 1997

By-catch

"I believe that longlining is one of the least harmful fishing methods. Our operations result in a minimal by-catch of marine mammals and sea turtles."
- Luis Correa, Vice President, PRFREEXPORT (Ecuador), June 12, 1996

"Sport fishermen are reportedly conducting a tag and release fishery for billfish out of the Galápagos. However, these species are beginning to appear in Galápagos fishery markets which means that not all of the catch is being released."
- Jack Grove, Conservation Network International, July 11, 1996

1.1

COLOMBIA

Colombia has no directed swordfish fishery. The species does not appear to be abundant in the country's coastal waters, although some observers caution that this apparent limited abundance may be due to the to the lack of directed fishing effort. Water temperatures off Colombia and Central America, both in the Pacific and Caribbean, are relatively high. While swordfish themselves can tolerate a wide temperature range, the warmer temperatures may not be ideal for the species which swordfish feed on, either directly or indirectly. Other oceanographic conditions also do not appear to be optimal, especially the lack of pronounced oceanic temperature fronts during much of the year. Small quantities of swordfish, however, are taken off Colombia, mostly by foreign fishermen. More substantial quantities are taken in oceanic waters at latitudes off Colombia, but much of this fishing is conducted into the central Pacific. The results reported by foreign fishermen, especially the Japanese, suggest that the latitudes off Colombia are the northern limit of their southeastern Pacific longline fishery. These results, however, may not precisely reflect actual swordfish abundance, especially as the Japanese generally were not targeting swordfish. The foreign results, however, constitute the best available data and at least provide an initial working hypothesis on possible distribution. Colombia manages the largest Latin American licensing program for foreign fishing vessels, but requires those fishermen to work in association with domestic Colombian companies. Most of the foreign tuna vessels licensed are purse seiners, but there are also a few longliners. Colombia has released no information on incidental swordfish catches of the licensed foreign vessels, but Japanese longline fishermen have provided data on swordfish catches showing limited results off Colombia. Some data is also available from the associated Colombian companies. The incidental swordfish catch of the domestic Colombian fishermen is very small. Colombia has in recent years developed a sizeable tuna fishery, but it almost entirely utilizes purse seiners (both foreign and domestic) which do not take significant numbers of swordfish. There is no domestic Colombian commercial longline fleet, but Colombian interest in a possible longline fishery appears to be growing. Several groups have worked with foreign, mostly Asian, longliners in fisheries for oceanic pelagics. One Colombian company reported some successful swordfish fishing during 1995, but did not pursue commercial operations because of high mercury content in the fish. Another company attempted to market fresh landings from an associated foreign longliner, but found it difficult to reserve air cargo space. Some activity has been reported in 1997. One company is refitting a shrimp trawler in 1997 for longline operations. Another company is doing test fishing in the Pacific with a Canadian longliner and is discussing possible longline association agreements with New Zealand and United States fishermen. Artisanal fishermen deploy a few small longliners, primarily for sharks. These fishermen report limited billfish (mostly sailfish and marlin) and tuna catches, but minimal quantities of swordfish. Most of the artisanal shark and much of the tuna and billfish is marketed domestically. Colombia exports virtually no swordfish, but does export small quantities of billfish to Japan. There is no known Colombian research underway on swordfish.

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I. Fishing Industry Overview

Colombia has the smallest fishing industry of the larger Latin American countries. The entire fisheries catch was only about 70,000 tons (t) as recently as 1985 (appendix B1a). Fishermen reported relatively stable catches during the 1970s, but began to gradually increase output by the mid-1980s. The industry played a very small role in the national economy. One Colombian study in the mid-1980s estimated that the fisheries contribution to the economy was only about 0.4 percent of overall production.[1] The industry did, however, provide needed employment--although most of the employment was in the artisanal sector with relatively low earnings. While the industry played a modest nation-wide role, it had local importance to the economy of the coastal regions--which included some of the country's most economically depressed areas. The employment provided by the fishing industry was particularly important in these areas where relatively few alternative job opportunities exist. The industry also provided food for these isolated rural communities.

Colombia's artisanal fishery, until recently, dominated the country's fishing industry--far outstripping production from the small commercial sector.

Artisanal: The fisheries catch, especially product destined for the domestic market, has traditionally been harvested primarily by artisanal fishermen in inland waters. The gear and methods used by the fishermen were in most cases extremely primitive. The number of individuals involved, however, was significant. One press report indicted in 1989 that there were about 120,000 artisanal fishermen active in Colombia.[2] The large freshwater catch, entirely artisanal, averaged over 50,000 t and exceeded the marine catch until 1989.

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Figure 1.--Map of Colombia.

Commercial: The primary commercial fishing activity during most of the 1970s and 80s was the shrimp trawl fishery conducted along both the country's Caribbean and Pacific coasts. The commercial fishery focused primarily on export markets and thus were an important source of foreign exchange earnings.

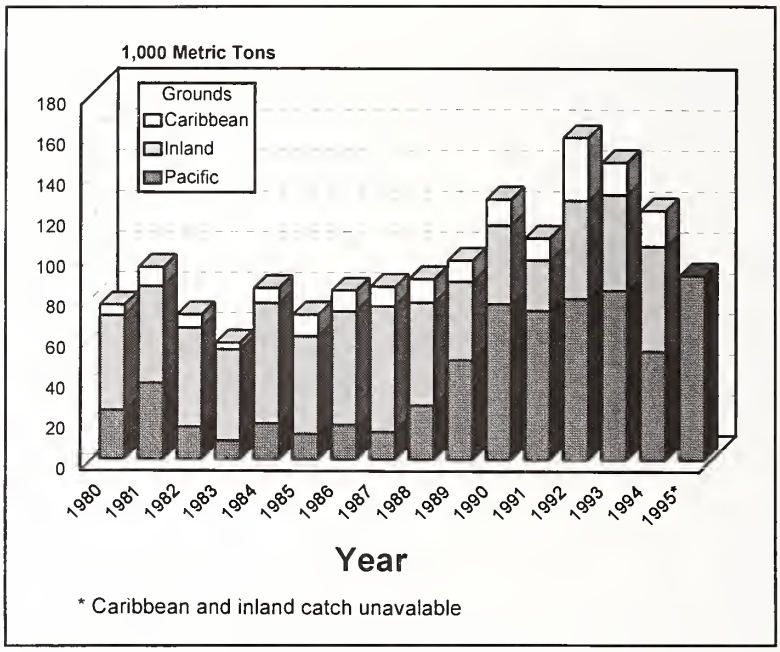

Figure 2.--Colombia reported important catch increases during the 1990s. Most of the catch has been traditionally taken in inland waters, but the Pacific is now the country's principal fishing grounds.

Several major developments in Colombia's fishing industry have occurred in recent years which have significantly affected both the artisanal and commercial fisheries:

Domestic fishery expanding: Both artisanal and commercial fisheries have expanded significantly. Colombian fishermen have greatly increased effort. Fishery catches, as a result, reached a record approaching 160,000 t in 1992 (appendix B1a and figure 2). The catch declined somewhat in 1993 and more sharply to 120,000 t in 1994, but was still well above levels reported during the 1980s. A sizeable decline occurred in the valuable tuna catch (appendix B3d). The fishermen reported a particularly successful year in 1995, achieving record results of more than 167,000 tons. The tuna catch recovered strongly from the weak 1994 season.

Expansion of marine fishery: The increasing catch has come primarily from marine grounds. Very significant increases in the marine fishery were reported in 1989 and 1990, especially along the Pacific coast. The marine catches first exceeded freshwater catches in 1989. This was unusual in Latin America because in almost all other coastal countries the marine catch greatly exceeds the generally modest freshwater catch. Record catches were reported in the Caribbean during 1992 and in the Pacific during 1993 (appendix B1a). While a substantial catch decline occurred in 1994, the fishermen reported another record harvest in 1995. The increase was primarily due to expanding activity on marine grounds, mostly for small pelagic species reduced to fishmeal and oil (appendix B1b).

Large foreign licensing program: Colombia has initiated an extensive vessel licensing program attracting 100-200 foreign fishing vessels annually (appendices A1a, A2, A5a-c, and A6a-d). This is the largest licensing program in Latin America and accounts for a substantial proportion of the overall commercial catch, especially the catch of tuna and shrimp.

New shrimp culture industry: The shrimp harvest in recent years has been supplemented by the new shrimp culture industry. Colombia has become the second largest producer of cultured shrimp in Latin America.[3]

Photo 1.--Colombia has expanded its commercial fishing fleet, adding several small tuna purse seiners, mostly less than 400 tons, in recent years. Luis Zapata

***Photo 2**--Colombian fishermen have significantly increased their tuna landings in recent years, primarily yellowfin and skipjack. Armando Hernandez.*

New tuna industry: Colombia began developing a major tuna industry during the late 1980s. The industry processes and transships the catch of the international fleet operating in the eastern tropical Pacific (ETP). Tuna is now one of the country's two major fishery export sectors. It directly and indirectly generates about 10,000 jobs, many of which are well paying jobs in regions of marginal economic development.[4] In addition to the modern processing plants, Colombia has also acquired its own domestic fleet of modern purse seiners (appendix A5b and photo 1). The industry is primarily geared to supplying yellowfin and skipjack tuna to domestic and foreign canners (photo 2). (See "Processing and Products.")

The Colombian fishery is conducted on three principal grounds (figure 2).

Inland: Until recently the great bulk of the Colombian fisheries catch was taken in inland waters by artisanal fishermen. The inland catch has fluctuated somewhat in recent years, declining to low levels in 1989-91. It recovered in 1992 and by 1994 was again over 50,000 t--comparable to the levels reported in the mid 1980s.

Caribbean: Caribbean catches have increased significantly in recent years, peaking at over 30,000 t in 1992. The 1994 catch, however, declined to only about 18,000 tons. While down substantially from 1992, Caribbean catches during 1993-94 were still well above levels reported during the 1980s. The Caribbean catch is normally only about one-half or one-third of the Pacific catch (appendix B1a and figure 2). While relatively small, the Caribbean catch is more diverse than the Pacific catch and is composed of several high value species--including snapper, grouper, shrimp, lobster, conch, and others.

Pacific: Pacific catches during the early 1980s were comparable to the small Caribbean catch. Pacific coast fishermen have since significantly expanded operations and the Pacific catch exceeded inland catches for the first time in 1989. The Pacific catch reached record levels totaling 83,000 t in 1993, but declined to only 54,000 t in 1994 (appendix B1a). Another new Pacific record was set in 1995 (figure 2). Much of the Pacific catch is composed of either tuna (mostly yellowfin) or anchovy and other low-valued small pelagics (appendix B1b and figure 3).

Considerable progress was made during the early 1990s to begin utilizing the country's marine resource potential. Colombian industry sources insist that the country has significant fisheries potential. They report a wide variety of species along both coasts which could be utilized by commercial fishermen, favorable environmental conditions, a dynamic private sector, and Government agencies giving increased attention to the fishing industry.[5] Private investors in recent years have focused on the tuna fishery, acquiring a few modern seiners and building several large, modern processing plants. Fishermen expanded the overall catch significantly during the late 1980s and early 1990s. The catch more than double between 1985 and 1992. The 1992 peak totaled nearly 160,000 t (appendix B1a and figure 2). Colombian catches, however, declined to only a little over 120,000 t in 1994--primarily because of significant reductions in the fleet. Both domestic and foreign fishermen have withdrawn vessels. The tuna catch fell to the lowest levels since 1988 (appendix B3d). Exporters reported record shipments in 1994, but this was primarily due to improved earnings from cultured shrimp and, to a lesser extent, canned tuna. Much of the capture fisheries sector

reported financial difficulties in 1994.[6] The fishing industry appears to have since recovered strongly, setting a new all-time catch record of 167,000 t in 1995. The tuna catch exceeded 40,000t and, while not a record, was well above 1994 levels. Industry observers report, however, that the industry's development is constrained by the short-term outlook of many companies. The business climate, especially high inflation rates, partially explain the short-term focus of many companies.[7]

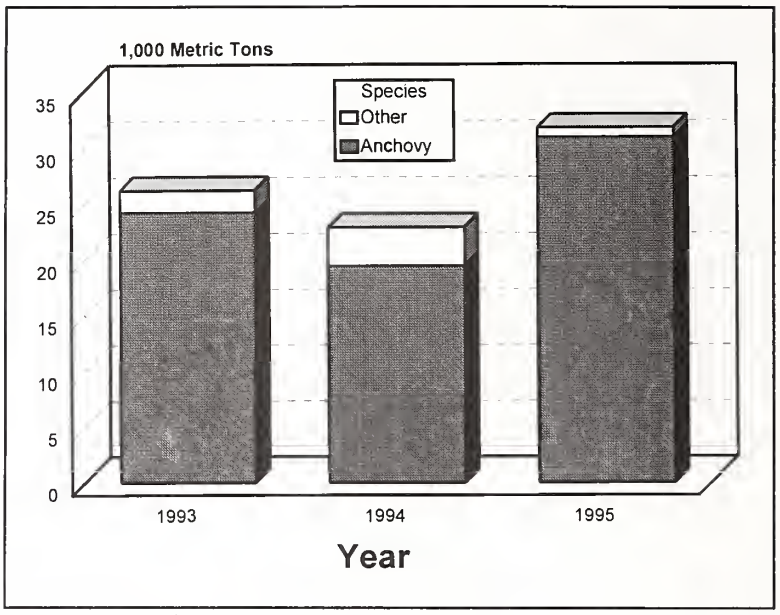

***Figure 3**.--Most of Colombia's non-tuna Pacific catch is anchovy and other small pelagic species.*

Colombia conducts a small fishery for high-value finfish and shellfish. Fisheries for these high-value species are largely conducted by artisanal and small-scale commercial fishermen.[8] The Colombian fishermen producing high-quality fish have primarily targeted demersal resources and, with the exception of purse-seine caught tuna, the production of oceanic pelagics (tunas, billfish, swordfish, sharks, and other species) is more limited. A few foreign vessels working under association contracts are also involved in the fishery for high-value species, including a few longliners targeting oceanic pelagics. Fishing activity for many high-value finfish species are currently centered primarily in the Caribbean and focuses on grouper and other demersal species.[9] Industry sources, however, report declining catches and exports of several heavily targeted demersal species.[10] Shipments of fresh grouper to the United States, for example, declined from $1.5 million in 1993 to negligible amounts in 1996 (appendix E3c). Many companies are convinced of the need to diversify into new fisheries.[11] Fisheries along the Pacific coast did not develop as rapidly as along the Caribbean because of the less well-developed infrastructure. The Pacific coast is lightly settled and the connecting transportation links with Colombia's main population centers are more limited--although greatly improved in recent years.[12] The large catch taken in the Pacific are mostly composed of a small number of species, primarily tuna and low-value small pelagics such as anchovy which are reduced to fishmeal (appendix B1b and figure 3). It is likely, however, that as the fishing industry develops, Colombian fishermen will increasingly target still under-utilized Pacific resources.

Photo 2A.--Colombian tuna purse seine being retreived with power block after a set. The fishermen report a substantial by-catch, but rarely a swordfish. Manuel Ramírez

II. Species

A. Distribution

Only limited information is available on swordfish distribution off Colombia. The species does not appear to be abundant along either the Caribbean or Pacific coast, although this assessment is based largely on catches from foreign fisheries in which swordfish was a by-catch. Some observers stress that extensive directed fishing operations have not yet been conducted on swordfish. The authors know of no stock study, but available catch data and anecdotal accounts suggest relatively low availability. This may be due, at least indirectly, to the relatively warm water found along both the Pacific and Caribbean coasts. Other oceanographic conditions could also be involved, especially infrequent pronounced temperature fronts through much of the year. (See "Fishing Grounds".) One local observer suggests that while swordfish abundance off Colombia may be limited, there could be *cul de sacs* of localized abundance.[13]

Research: There is no Instituto Nacional de Pesca y Acuicultura (INPA) research program on oceanic pelagics, including swordfish.[14] The authors have been unable to identify any Colombian research on swordfish addressing stocks or describing the species behavior--understandable given the limited importance of the species in the local fishery. (See "Research.")

Domestic fishermen: Available literature describing the Colombian artisanal, commercial, and recreational fisheries suggest low availability of swordfish. Actual catches may not, however, fully reflect availability.[15] Colombia has still not developed a domestic commercial longline fishery, although some research is underway. (See "Research.") Important commercial fisheries such as shrimp trawling and tuna purse seining do not normally take significant numbers of swordfish as a by-catch. The mesopelagic habits of swordfish and its non-aggregating behavior mean that swordfish by-catches in surface purse seines and bottom trawls are unusual.[16] Therefore, results from these fishing operations do not offer insights on swordfish abundance. Domestic longlining is mostly conducted by the small artisanal shark fishery, deployed primarily along the Pacific coast. A few trawler fishermen occasionally rig their vessels to deploy longlines.[17] There is also some limited longlining and driftnetting by small-scale artisanal fishermen in the Caribbean. (See "Fleet Operations and Gear".) Swordfish by-catches, however, are probably limited by the largely coastal nature and relatively shallow sets of these fisheries.[18] Much of the other artisanal operations is still conducted in inshore waters where there would be no swordfish by-catch.

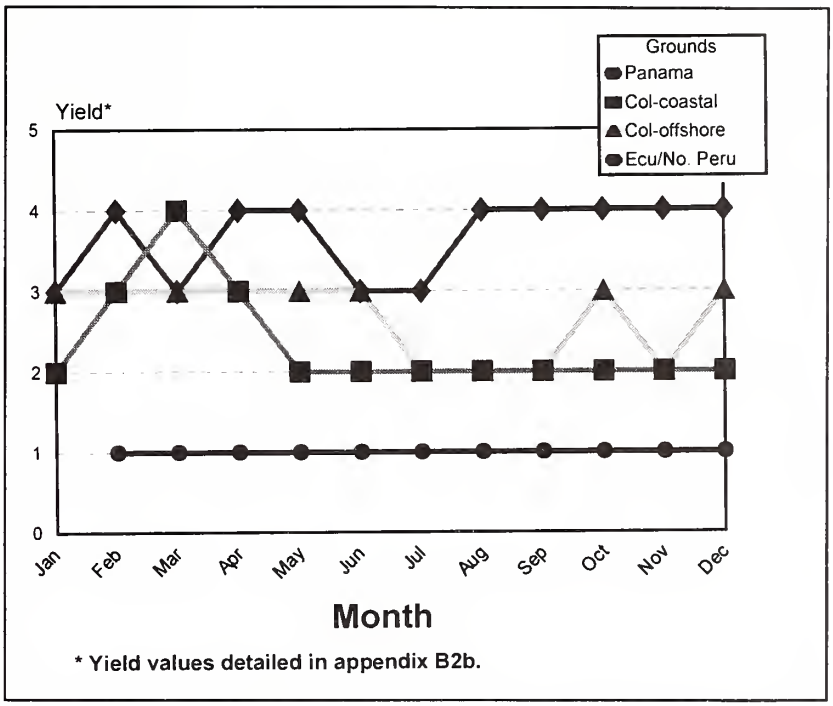

Figure 4.--Foreign longliners report relatively small seasonal fluctuations of swordfish taken in Colombian coastal waters. Even smaller catches with fewer fluctuations are reported off Panama.

Foreign fishermen: Reports from foreign fishermen also suggest relatively limited availability of swordfish. Commercial catches are reported seasonally off Colombia, primarily by the Japanese. In addition, two neighboring countries (Ecuador and Venezuela) take swordfish in commercial quantities. The Venezuelans do not take swordfish in areas adjacent to the marine boundary with Colombia. The Ecuadoreans report small catches off their northern coast near the Colombian marine boundary.

Distant-water countries: The primary distant-water fishing country targeting tuna and swordfish off Colombia has been Japan (Latin America, appendix

C2b). In the Pacific, historic Japanese yield data show that the waters off Colombia are not the best fishing grounds. Some fish are taken there throughout the year, however, and some moderately good fishing is reported seasonally (appendix B2b and figure 4).[19] Recent distant-water catch data confirm that swordfish are present in the Pacific oceanic waters off Colombia, but that catches are rare.[20] Better results are reported to the south and west. In the Caribbean, Colombian waters are the only area where the Japanese continue to report longline activity and catches include swordfish.[21] Japanese longline fishermen, some using flag-of-convenience registrations, operate longliners under Colombian licenses.[22] (See "International".) Reports on swordfish catches, however, differ. One associated Colombian company, reports that the foreign longliners take virtually no swordfish (appendix B4 and figure 23).[23] Some Colombians work aboard these vessels.[24] These workers and observers confirm that little swordfish is taken.[25] Japanese longline data through 1993, however, continued to show swordfish activity.[26] The Instituto Nacional de Pesca y Acuicultura (INPA) has an observer program for purse seiners associated with dolphin protection efforts, but this does not include the few longliners. There are also observers required on vessels with exploratory commercial fishing licenses.[27]

Neighboring countries: No data is available from neighboring countries on swordfish stocks. Catch trends, however, offer some indication of possible stock status.

Venezuela: Venezuelan longline fishermen conduct the largest Caribbean swordfish fishery and catches totaled about 430 t in 1995 (Venezuela, appendix C2a).[28] The Venezuelan fishermen, however, do not report any catches along their western coast near the Colombian border.[29] Their most westwardly catches are taken off the eastern side of the Paraguaná Peninsula, a promontory near the mouth of the Gulf of Venezuela--about 100 kilometers (km) east of Colombia's Guajira Peninsula.[30] Venezuelan fishing strategy, however, may be affected by other factors besides species distribution.[31]

Panama: Domestic Panamanian fishermen do not report swordfish catches off either the Caribbean or Pacific coast, but as in Colombia, there is no directed effort.[32]

Ecuador: Ecuadorean fishermen conduct a tuna longline fishery in the waters east of the Galápagos which has generally been taking only small quantities of swordfish as a by-catch.[33] Some companies are convinced that swordfish are not abundant off Ecuador, but report some limited catches off the northern and southern coasts.[34] Recent reports from Ecuador, however, suggest that the fishermen are beginning to target swordfish, especially in waters west of the Galápagos. The Ecuadorean Government reported catches exceeding 500 t in 1995 (Ecuador, appendix B2a).[35] The authors have, however, been unable to confirm such a large catch.[36]

Recreational fishermen: U.S. and other recreational fishermen have pursued swordfish off South America since the 1930s. These fishermen in the 1930s and 1950s reported considerable success in the Pacific off both Chile and Peru and assessed the waters off other Latin American countries.[37] One notable sport fishermen in particular worked the western coast of South America for swordfish, including Chile, Peru, and Ecuador, but in subsequent reporting did not even bother to mention Colombia (photo 3).[38] Current recreational fishermen continue to report limited

Photo 3.--Foreign sport fishermen targeting swordfish were active off Chile and Peru during the 1950s, but no fishing was reported off Colombia.

spottings of swordfish, although some billfish is taken (sailfish and marlin).

Several other large pelagic species occur in Colombian waters: tuna, billfish (sailfish and marlin), as well as a variety of sharks. The presence of these species, of course, does not mean that swordfish are necessarily present. Given the quantity taken, however, fisheries for these species should be assessed for information on possible swordfish distribution. It is possible that if commercially exploitable concentrations of swordfish occurred off Colombia, at least a few swordfish would also be taken. Some observers caution, however, that the fishing strategies are so distinct that interactions are unlikely.[39] The species composition of the by-catch, however, is highly dependent on the target species.[40] The commercial swordfish fisheries conducted in South America (Brazil, Chile, Uruguay, and Venezuela) report large incidental catches of sharks as well as billfish, if present, in local waters.[41]

Tuna: Colombian tuna operations are surface purse-seine fisheries and as a result there are minimal swordfish by-catches. Foreign fishermen, however, deploy longlines for tuna and do report swordfish by-catches.[42] The largest swordfish by-catches are generally reported in longline fisheries targeting bigeye rather than yellowfin.[43] The primary foreign longline fisheries off Colombia's Pacific coast have been for bigeye, although some yellowfin is also taken.[44]

Billfish: The most common billfish found off Colombia are sailfish and marlin which are most prevalent along the Pacific coast (appendix B3a2 and figures 20-22). Blue marlin is currently the principal marlin species, although stripped marlin becomes more important in the waters south of Colombia.[45] The Japanese extensively targeted tuna in the Caribbean and during the 1960s reported finding substantial billfish stocks in the Caribbean off Colombia. Japanese fishing by the 1990s had declined sharply and thus was no longer a possible indicator of stock status. There were, however, still some limited catches off the Caribbean coast.[46] INPA reports Colombian billfish catches primarily in the Pacific (appendix B3a2 and figure 22). Along the Pacific coast, Colombian artisanal (semi-commercial) shark and dorado longline fishermen and artisanal driftnet fishermen are responsible for most of the billfish catch (photo 4).[47] Along the Caribbean coast, billfish are usually taken by artisanal fishermen operating "cayucos" and "fibras de vidrio" in mostly day-trips.[48] (See "Fleet.") Some commercial catches, however, are also reported in the Caribbean (appendix B3a2). One observer stresses that billfish are caught by day in shark longliners while swordfish are caught at night, explaining the small billfish and tuna by-catch and limited swordfish by-catch.[49]

Shark: Colombia reports a shark resource including 12 species along its Caribbean coast (appendix G).[50] Several species occur in even greater quantities off the Pacific (appendix B3b1). The Colombians take much larger catches of shark than billfish. The largely coastal nature of these operations and daytime sets, however, limit possible swordfish by-catches. Swordfish feed at night and in tropical and sub-tropical waters at some depth. Swordfish longliners take advantage of this by setting their lines in the evening and leaving them active at night. The Colombian shark longliners, on the other hand, set during the day, thus significantly limiting possible swordfish by-catches--even if swordfish were present in Colombian waters.[51] Given the level of the Colombian effort on shark, however, one might think that an occasional swordfish would be taken if the species was present in commercial quantities.

B. Stock structure

The stock structure of swordfish occurring off Colombia, both in the Pacific and Caribbean, is not known. Tagging data, the most definitive evidence does not exist to confirm stock structure off either coast. Available evidence, however, offers some clues suggesting that the fish in Colombian waters appear to be simply a fringe population of the north Atlantic stock and a theorized southeastern Pacific stock. Along Colombia's **Caribbean coast**, swordfish appear to be the western-most appearance of the large north Atlantic stock. The greatest abundance of swordfish in the Caribbean appears to be off Venezuela, well to the east of Colombia. Along Colombia's **Pacific coast**, swordfish appear to be on the northern fringe of a possible separate southeastern Pacific stock. The Latin American fishery on this theorized stock is primarily centered on the coastal waters off southern Peru and Chile while the Japanese fishery (the primary distant-water fishery) is mostly conducted in offshore waters at latitudes off Colombia, Ecuador, and Peru. (See "Fishing Grounds".)

1. Pacific

Some evidence suggests that the swordfish along the coast of South America may be a separate southeastern Pacific stock with distinct genetic differences, but not completely isolated from a larger pan-Pacific stock. Swordfish in the northern and western Pacific appear to be one large pan-Pacific stock, although considerable discussion on the issue

continues.[52] Factors suggesting that swordfish in the southeastern Pacific may be a separate stock from the wider pan-Pacific stock include:

Catch patterns: The geographic clustering of catches strongly suggests a separate, but not isolated southeastern Pacific stock. Seasonal catch patterns are more ambiguous.

Geographic: Available data on current and historical fishing patterns provide some evidence for a separate, but not completely isolated, southeastern Pacific stock. Fishing patterns for most major fishing countries suggest that swordfish are taken widely in the Pacific, but there is a discernable area in the southeastern Pacific where swordfish catches are more important than in surrounding areas.[53] Japanese longline fishing patterns in particular during the 1990s show a distinct, but not isolated clustering of catches in the southeastern Pacific.[54] Historic Japanese yield data for 1952-85 show a similar clustering in the Pacific, although the southeastern Pacific cluster of high yields is less well defined than with the catch data (Ecuador, figure 8).[55] The latitudes off Colombia and northern Ecuador appear to be the northern-most limit of significant catches from this theorized southeastern Pacific stock.[56] Such geographic catch clusters in many fisheries can be indicators of separate populations. Latin American fishing patterns discussed in the individual country chapters add to their southeastern cluster provides further evidence of a possible distinct southeastern Pacific population.[57]

Annual fluctuations: The Japanese fishery in the southeastern Pacific (FAO area 87) peaked in 1992 at 1,027 t (Latin America, appendix C2b). The Japanese catch had declined to 690 t by 1994. The authors stress, however, that the Japanese fishery in recent years is a multi-species fishery targeting primarily bigeye. Fluctuations in the swordfish catch may thus not reflect actual swordfish abundance. While there is no Colombian swordfish data, results from Chile (the other major southeastern Pacific swordfish fishery) correspond to the Japanese trends--although the Chilean decline is much more pronounced. The Chileans like the Japanese have reported major catch declines in the 1990s. The Chilean fishery peaked at over 7,250 t in 1991 and has since declined to only about 2,600 t in 1995 (Chile, appendix E2a1).

Seasonal fluctuations: Seasonal swordfish fluctuations off Colombia are difficult to assess. Colombian fishermen do not target the species and, as a result, there is no available domestic catch data. The Japanese have published detailed longline catch and yield data, but the patterns shown by this data are not easily assessed. Historic yield data suggests that seasonal patterns along the Colombian coast and immediate offshore areas are quite similar. The seasonality, however, appears different than reported off Ecuador immediately to the south.[58] (See "Seasonality" below.)

Genetic similarity: Some genetic research suggests a possible separate southeastern Pacific stock. Genetic research is relatively new and the number of samples assessed from the southeastern Pacific are very limited. U.S. researchers, for example, have only assessed samples from Ecuador and Chile along the western coast of South America. The preliminary results of those analyses, however, show little genetic diversity between the Ecuadorean and Chilean samples, but significant diversity with samples from other Pacific fisheries.[59] This suggests that the southeastern Pacific swordfish population could be a separate stock. This conclusion, however, is still tentative and not shared by all genetic researchers. A Japanese geneticist, for example, using different methods from the U.S. research group has not found evidence confirming a separate southeastern Pacific stock.[60] While no samples of swordfish taken off Colombia have been assessed, given the location close to Ecuador, current flow, and many similar oceanographic conditions, the Colombian fish would probably be part of a theorized southeastern Pacific stock. U.S. researchers believe that the waters off southern California and Mexico's Baja Peninsula may be a mixing ground for pan-Pacific and southeastern Pacific fish.[61] Future genetic assessments of swordfish taken off Colombia and Central America may provide important clues concerning the relationship between swordfish in the southeastern and wider Pacific. IATTC is initiating some genetic testing in the southeastern Pacific.

Oceanography: The Humboldt Current (Chile/Peru Current) creates a coherent large marine ecosystem (LME) off the western coast of South America (Peru, photo 13).[62] While the current is strongest off Chile and Peru, it also has a seasonal impact off Ecuador and to a lesser extent off Colombia. The impact is partly reflected in the similar species mix and shared stocks, including prey species, found in Ecuadorean and Colombian waters. Thus it seems at least plausible that the occasional swordfish found off Colombia may be the fringe of a southeastern Pacific stock found to the south.

Underwater topography: The coast off Colombia and northern Ecuador are partially enclosed within the Panama Basin. (See "Fishing Grounds".) This suggests that many of the fishery stocks within the basin will be shared trans-boundary stocks. This almost certainly would be the case for a highly migratory species like swordfish.

2. Caribbean

International Commission for the Conservation of Atlantic Tunas (ICCAT) researchers have generally concluded that swordfish in the north Atlantic, including the Caribbean, is a single stock, with the exception of the Mediterranean.[63] Catch patterns, limited tag returns, and preliminary genetic studies (Latin America, appendix B4) tend to confirm this conclusion. Thus, while no separate data is available specifically on the few swordfish found along Colombia's Caribbean coast, oceanographic patterns suggest that the fish off Colombia are probably related to the population fished off Venezuela and are part of the wider north Atlantic stock.[64]

C. Migrations

The authors have no available information on swordfish migrations off Colombia. There are no tagging studies to substantiate migratory movements.

Caribbean: Swordfish may be following the flows of the Caribbean (CC) and Caribbean Counter (CCC) Currents. (See "Fishing Grounds.") Researchers have theorized the use of ocean currents in some areas as migratory pathways, but such hypothesis are highly speculative.[65] Some fishery-related data from areas of strong current flow (Gulf Stream and Humboldt) suggest a seasonal movement in the direction of the current flow.[66] Supporting tagging data to confirm this relationship, however, is unavailable. At least one Venezuelan swordfish specialist does not believe swordfish in the Caribbean off Venezuela are following CC as the current flow is relatively weak and the CCC is weaker still off Colombia. He believes that swordfish are simply foraging in areas of high prey density which may be associated with thermal fronts.[67]

Pacific: The movements of swordfish between Colombian waters and fishing grounds to the north (Mexico/United States) and south (Peru/Chile), where the species is more abundant, are undocumented and poorly understood. Available data is very limited and has serious limitations which compromise its utility.[68] The authors have attempted to assess the limited available data, but stress that the very tentative indications which emerged are highly speculative and intended only to suggest possible scenarios to be tested when more extensive, reliable data becomes available.

East: Swordfish off Colombia may be moving east and west, seasonally off and then back toward the coast. Available foreign catch data provides some support for possible east-west movements. The best Japanese catches off Colombia during the early 1990s were reported in the third and fourth quarters of the year. The best catches in many, but not all, offshore oceanic areas at latitudes off Colombia are in the second quarter of the year. The seasonality of swordfish at tropical latitudes, however, appears highly complex and variable.[69] Thus the authors were unable to construct even a tentative hypothesis concerning possible overall migratory movements. (See "Seasonality" below.)

South: There almost certainly is some movement to the south. The Japanese reported that the peak season for fishing off Colombia was the second half of the year, while the peak season off Ecuador was the first half of the year.[70] This suggests possible north-south movements. Mixing with the population to the south could be occurring in offshore areas as a result of east-west movements. (See "East" above.) Japanese longline data show areas of limited catches and low abundance off the northcentral Peruvian coast.[71] Thus there may be some separation within the southeastern Pacific in coastal waters, but mixing in more oceanic areas. This raises the possibility that east-west movements may play a significant role in the mixing of fish in northern and southern sectors of the southeastern Pacific.

North: There may also be some limited movement to the north. Some preliminary genetic studies suggest possible mixing of southeastern Pacific and the wider pan-Pacific stock in the waters off the United States (California) and Mexico (Baja Peninsula).[72] The track of fish moving between southern California/Baja Peninsula and South America is unknown. Large numbers of fish are not necessarily required for significant genetic exchanges. such exchanges could be taking place through both oceanic and coastal movements.

Coastal track: Some fish could be moving through Colombian coastal waters. Only small numbers of fish may be involved in such movements. Available catch and effort data, however, show very limited swordfish catches and low yields in coastal areas off Central America and southern Mexico.[73] There does, however, seem to be some similarity in the peak seasonal appearance of swordfish off Colombia and Central America (third quarter) and Mexico (fourth quarter).[74]

Offshore track: The Japanese notably report moderate yields in offshore areas between southern California/the Baja and South America. The historical yields pattern in these offshore areas fluctuated seasonally, but were often particularly distinct during December.[75] This suggests that fish movement and exchanges

between southern California/the Baja and South America could be taking place in oceanic waters at some distance from the coast (120-140°W) rather than along the Colombian (78-79°W) and Central American (80°-105°W) coast.

D. Spawning

No information is available on the maturation of swordfish off Colombia. The presence of larvae is one way of assessing possible spawning activity. Various distant-water fishing countries have conducted extensive plankton surveys in the Pacific. These researchers have so far found no swordfish larvae in coastal areas of the eastern Pacific, east of 108°W.[76] While the research effort in the eastern Pacific has been more limited than in the western and central Pacific, the absence of larvae strongly suggests that swordfish are not spawning off Colombia. INPA reports that they have never encountered swordfish larvae in any of their plankton studies.[77] This also appears to be the case all along the Pacific coast of South, Central, and North America--with one exception.[78] Ecuadorean researchers have recently reported finding small numbers of swordfish larvae in plankton studies in the Gulf of Guayaquil.[79]

E. Seasonality

The authors have only limited data on swordfish seasonality off Colombia. The limited data that is available suggests conflicting patterns. There is no Colombian data on swordfish seasonality. The country's swordfish catch is so small that the species is generally not even noted in INPA annual statistical reports on the fishing industry. Foreign fishing data provides some clues. Little information is available on Colombia's Caribbean waters, but more data is available to the authors on the Pacific. The Japanese have reported the most significant swordfish catches and their longline data provide some insight on possible seasonal fluctuations. The Pacific patterns reported by the Japanese and other foreign fishermen, however, are complex and highly variable. In addition, there are substantial differences between available data sets. The fact that swordfish was not the target species further compromises the data, especially in assessing seasonality.

Japanese yield data: Historic Japanese yield data (1952-85) show limited seasonal fluctuations, but somewhat higher yields--mostly in the first half of the year. The highest yields in Colombian coastal waters (east of 80°W) are reported from February through April and then decline somewhat from May through December (appendix B2b and figure 4).[80] The seasonal pattern in the oceanic area immediately off Colombia has a similar pattern, although the period of slightly higher catches is longer, from December through June. Yields off northern Central America (Nicaragua north to Guatemala) also appear to peak during the first half of the year (appendix B2b). The peak season for swordfish off Colombia appears to coincide with lower yields in the ETP high-seas fishery.

Foreign catch data: Foreign longline catch data (primarily Japanese) compiled by FAO for 1991-93 show a somewhat different pattern. The international fleet as a whole during 1991-93 showed no swordfish catches along the Colombian coast, but some in the oceanic area off the country's southern coast. The best catches off Colombia (west of 80°W) were reported in the third quarter of the year. Catches in nearby coastal areas off Central America (Guatemala and El Salvador) also peak in the third quarter. Catches in many of the offshore oceanic areas to the west of Colombia appear to peak in the second quarter, although the pattern is highly variable. Interestingly, to the southwest into oceanic areas (but not immediately south along the coast of Ecuador and northern and central Peru), the third quarter is often the peak catch season.[81]

The highly complex seasonal catch and yield patterns off Colombia, Ecuador, and northern Peru make assessing possible migratory patterns extremely difficult. Available data, however, does offer some clues on possible migratory behavior off Colombia. Comparing seasonal catch and yield fluctuations in adjacent areas provide some indication as to possible migratory movement. The authors stress, however, that seasonal patterns shown by the available data, are not direct evidence of migratory behavior. This is particularly true as swordfish was not the target species. Migrations can only be conclusively established by tagging and no such data exists. Despite these limitations, the available data do suggest some possible patterns which could warrant further investigation. The pattern is highly complex. Within the theorized southeastern Pacific stock there may be a variety of overlapping migratory movements. While complex, the data does show some discernable patterns and it appears that swordfish movement is clearly not random.

North: No Central American seasonal catch data is available for the countries to the north and west of Colombia. Swordfish is rarely taken by Central American fishermen.[82] Some foreign (mostly Japanese), seasonal data are available. The low catch rates and relatively high sea surface temperatures (SSTs) off Central America suggest that swordfish

movement north may be very limited.[83] Further north, the Mexican fishery off the Baja begins in August/September, declines by February and usually ends by May (Mexico, appendix D2 series).[84] This appears to correlate inversely with the historic yields reported by Japanese longline fishermen off Colombia, suggesting a possible migratory shift (appendix A3b). More recent Japanese catch data (1991-93), also suggests a seasonal movement--although the monthly pattern is somewhat different. The Japanese catches off Colombia and Central America (Nicaragua/El Salvador), although limited, were highest during the third quarter and most prevalent off Mexico during the fourth quarter.[85]

West: Catches to the west of Colombia in international waters have been reported by Japanese longline fishermen. Historical data suggests a distinct seasonality to the oceanic fishery west of Colombia at latitudes off Colombia, Ecuador, and northern Peru (5°N-5°S). Yields in the offshore areas as far as 145°W appear to improve when fishing off the coast declines and vice versa.[86] An analysis of 1991-93 catch data reveals a similar pattern. Catches immediately outside Colombian waters during 1991-93 were primarily reported during the third and to a lesser extent the fourth quarter, while peak catches were reported earlier in some adjacent areas.[87] While this suggests some possible east-west movement, the pattern appears so varied that it is difficult to theorize migratory patterns.

South: The Japanese have reported swordfish yield and catch data in both coastal and offshore areas to the south of Colombia off Ecuador and northern Peru. The data show the Japanese fishery was conducted at moderate levels and consistently throughout the year with only limited seasonal fluctuations. Fishing yields in this area are sometimes high during the same period in both inshore and offshore areas.[88] Recent actual catch data also show a highly varied and complex seasonal pattern in the waters south of Colombia. The seasonal pattern off Ecuador and northern and central Peru, however, appears to be just the opposite of the Colombian pattern.[89] One possibility is a movement northward in coastal waters beginning along the northern Peruvian coast (first quarter), off Ecuador (first half of the year), Colombia and Central America (third quarter), and Mexico (fourth quarter).[90] Such inferences, however, are pure speculation and mentioned only as a possible migratory route to be assessed when more data becomes available.

Colombian domestic fishermen, while reporting virtually no swordfish catches, do report billfish catches. Catches of both marlin and sailfish appear highly seasonal, although this varies annually and the pattern is somewhat different for the artisanal and commercial fishermen (appendix B3c1-3 and figures 5-7).

F. Stock status

The authors have virtually no information on the status of swordfish stocks off Colombia. Some overall assessments are available for Pacific and Atlantic fisheries.

Pacific: Japanese assessments for the status of stocks in the southeastern Pacific as a whole suggest that through 1992 yields have tended downward since the mid-1970s, but are well above the extremely low levels reported in 1983.[91] Chilean fishermen who conduct the only large coastal fishery in the region have reported sharp catch declines since 1991, suggesting that the stock may be declining.[92]

Atlantic/Caribbean: ICCAT assessments for the status of the north Atlantic stock as a whole show a declining stock size reflected in falling catch-per-unit effort (CPUE). The biomass at the beginning of 1994 was estimated to be only 67 percent (range: 48-108 percent) of the biomass needed to achieve the maximum sustainable yield (MSY).[93]

***Photo 3A**--Colombian fishermen took this marlin in the Pacific along with numerous silky sharks (Carcharhinus falciformes). Gilbert Acevedo*

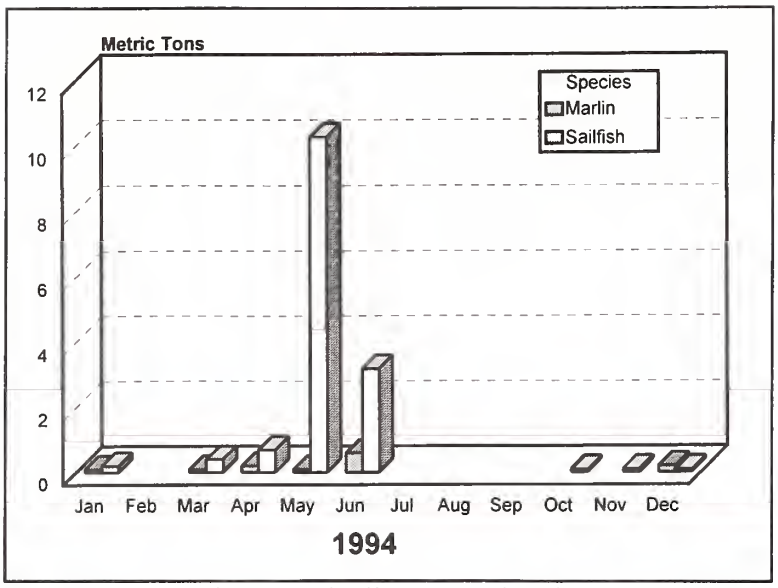

Figure 5.--Almost all of the artisanal sailfish catch was landed in May and June during 1994.

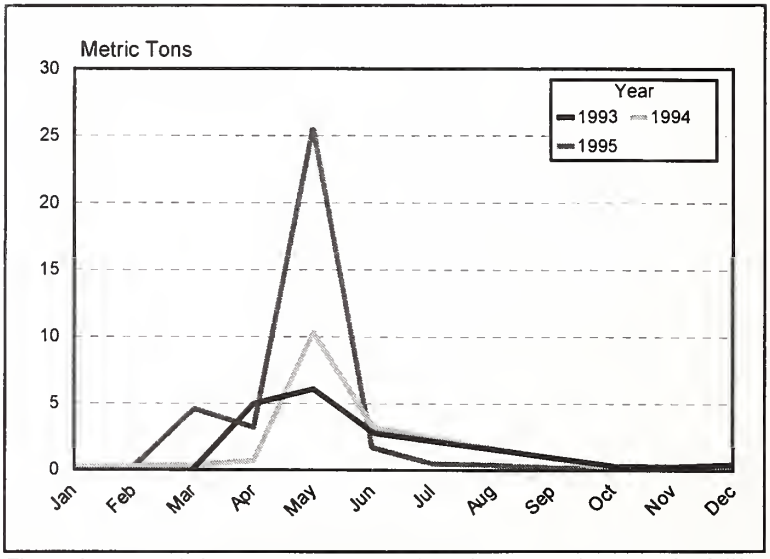

Figure 6.--Artisanal fishermen have reported similar seasonal pattern for billfish landings each year during 1993-95.

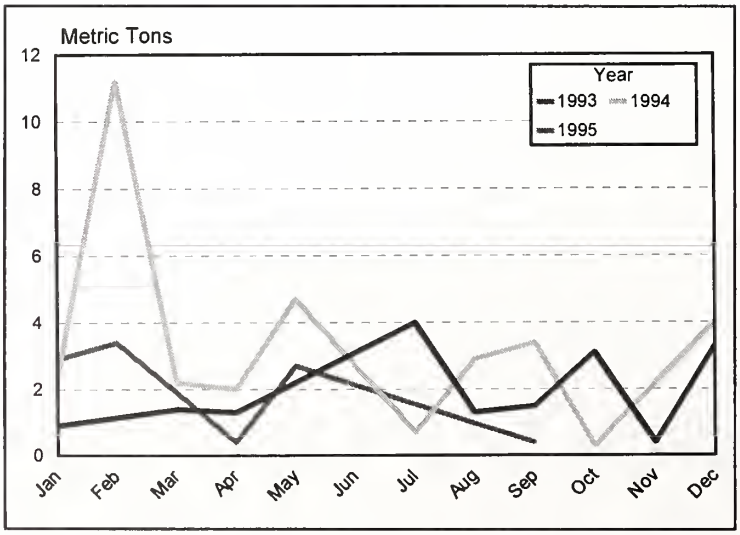

Figure 7.--Commercial fishermen report billfish catches with no clear seasonal pattern.

III. Fishing Grounds

A. Oceanography

Colombia has an extensive coastline along both the Pacific and Atlantic (Caribbean), extending about 2,900 kilometers. The area of the Caribbean Exclusive Economic Zone (EEZ) is larger than that in the Pacific because the country's Pacific EEZ is squeezed by that of Ecuador to the south and especially Panama to the north (figure 8). Central America extends west into the Pacific, far beyond the longitude of the Colombian coast, severely restricting Colombia's 200-mile coastal projection into the Pacific (figure 8).

Figure 8.--Colombia claims a substantial portion of the western Caribbean as a part of its 200-mile EEZ, but the country's Pacific EEZ is very small.

1. Pacific

Colombia's Pacific EEZ consists of only 330,000 square km because Central America (Panama and Costa Rica) extends far westward, effectively cutting into Colombia's coastal projection. As a result, Colombia has a relatively small Pacific EEZ compared to the two major Pacific-coast South American countries to the south, Peru and Chile (figure 8). Colombia does have one Pacific island, which has helped to extend the country's EEZ westward--Isla Malpelo (4°N, 82°W). The island is located about 450 km off Colombia's central coast. Without Isla Malpelo, Colombia's 200-mile EEZ would have been extremely limited.

Colombia's Pacific coast is located at tropical latitudes (2°-7°N). The marine fauna are mostly tropical species. The species diversity is much less than off southern Ecuador because the northerly flowing cold Humboldt Current is relatively weak at latitudes above the equator. The underwater Carnegie Ridge runs west from central Ecuador at about 2°S to the Galápagos Islands. The Panamanian, Colombian and northern Ecuadorean coast are located in the partially enclosed Panama Basin. The Basin is confined by the Carnegie Ridge to the south and the Cocos Ridge running southwest from Costa Rica until terminating at the Galápagos (0°, 90°W), about 1,000 km off the Ecuadorean coast. Within the Panama Basin the major feature is Colombia's Isla Malpelo and surrounding shelf area.

Fisheries productivity off Colombia is much more limited than off its southern neighbors (Peru and Chile), primarily because of the less extensive coastline, the much more limited coastal upwelling, and higher water temperatures (figure 9).[94] Colombian fishery catches trail even that of much smaller Ecuador. The shelf is narrow along most of the Colombian coast, providing only a limited shelf area of productive shallow water. While the available resource is smaller than that of the countries to the

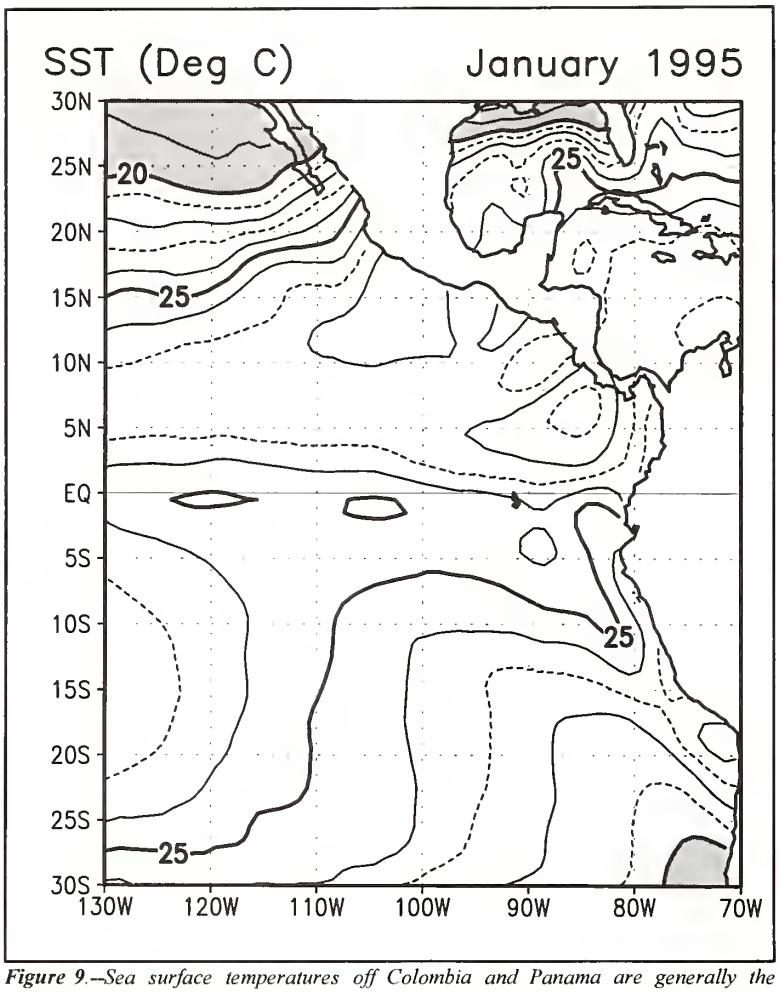

Figure 9.--Sea surface temperatures off Colombia and Panama are generally the highest reported in the eastern Pacific. Vernon Kousky, NOAA

south, Colombia's modest catch is in part due to the limited fishing effort deployed. Until recently, Colombian fishermen only utilized a small proportion of the potential Pacific resource.

Shelf: As with other Pacific coast countries in South America, the Colombian shelf is narrow--generally extending only about 25-50 km offshore. The shallow water on shelfs are often highly productive fishing areas. The country's narrow shelf places finite limits on the resource, especially demersal resources.

Upwelling: The relatively narrow shelf off countries south of Colombia does not limit fisheries production because of the massive upwelling system along the western coast of South America which supports immense stocks of small pelagic species. This upwelling system extends from central Chile (about 40°S) into the equatorial latitudes off Ecuador where it blends into the equatorial upwelling belt.[95] Upwelling along the Colombian coast, while limited, does exist. The largest fisheries reported by Colombia's Pacific coast fishermen are anchovy and other small pelagic populations which are supported by coastal upwelling (figure 3).

Currents: The waters off Colombia are a mixing area created by the convergence of the northerly flowing Humboldt Current and the easterly flowing North Equatorial Counter Current (figure 10). The mixing and current flow, however, are affected by the Cocos and Carnegie underwater ridges which enclose the Panama Basin. The semi-enclosed basin at tropical latitudes and relatively shallow depths partially explain the high water temperatures and limited seasonal variations often found within the basin and, as a result, Colombian coastal waters (figure 9).

Humboldt Current: The Humboldt Current follows the western coast of South America from southern Chile north. The strength of the Humboldt Current at northern latitudes (off Ecuador and Colombia) is highly seasonal. The relative weakness of the Humboldt Current by the time it reaches Colombia also impairs productivity and may further limit populations of swordfish prey species. Ocean conditions are also periodically affected by warm water anomalies referred to as El Niño events. During an El Niño event the intrusion of warm equatorial water can significantly limit upwelling off Ecuador and Colombia. This can cause dramatic shifts in water temperatures and can have a major impact on fish abundance and distribution, although the impact is more pronounced off southern Ecuador and Peru where water temperatures are not normally as high as commonly found off Colombia.

North Equatorial Counter Current: This is the second most important eastward flow in the equatorial current system. It is located at about 5°N and fed by the western boundary currents both from the south and the north. Its annual mean transport decreases uniformly with longitude, from 45 Sverdrup (Sv=km^3 per second) west of 135°E to 10 Sv east of the Galápagos Islands. As it approaches the Central American shelf, the current turns north, creating a cyclonic motion which results in a shallower thermocline. In the termination region of this current, its effect can be noted as the Costa Rica Dome (9°N, 88°E) where the thermocline averages only about 25 m in depth (figure 12).[96]

South Equatorial Current: The major westward component of the southern equatorial current system

is the South Equatorial Current. This current is often located a few degrees south of the equator. It is directly wind-driven and therefore responds quickly to variations in atmospheric conditions. It is also very seasonal, being strongest during the southern hemisphere winter (July-September), when the trade winds are the most pronounced. The South Equatorial Current is strongest during August when it reaches speeds of 0.6 m per second. This current starts moving water westward at about 2°S and 95°W, or about 500 km off the Ecuadorean coast.[97]

Changing oceanographic conditions can cause substantial fluctuations in the ETP fisheries catch, especially the Ecuadorean and Peruvian catches. The Ecuadorean fishery catches since 1985, for example, have ranged from 0.3 million t (1993) to 1.1 million t (1991) (Ecuador, appendix B1a). Peruvian catch fluctuations since 1970 have been even more dramatic, falling from a phenomenal 12.5 million t (1971) to only 2.3 million t (1973) in only 3 years, the most precipitous decline ever reported in world fisheries (Peru, appendix B1). The species most affected are the small pelagic species which are normally taken in large quantities while the impact on demersal species is more limited. Colombian catches in the past have not been as significantly impacted by El Niño warming events and other climatic fluctuations as the other Pacific-coast South American countries. This is in part because the SSTs off Colombia are normally relatively high. In addition, the fishermen were not heavily using the available resource. Thus declines in stocks did not as severely affect harvests. Colombian fishermen also generally target tropical species which are not as adversely affected by El Niño conditions. In fact, many tropical species, such as penaeid shrimp actually benefit from the warmer water temperatures.

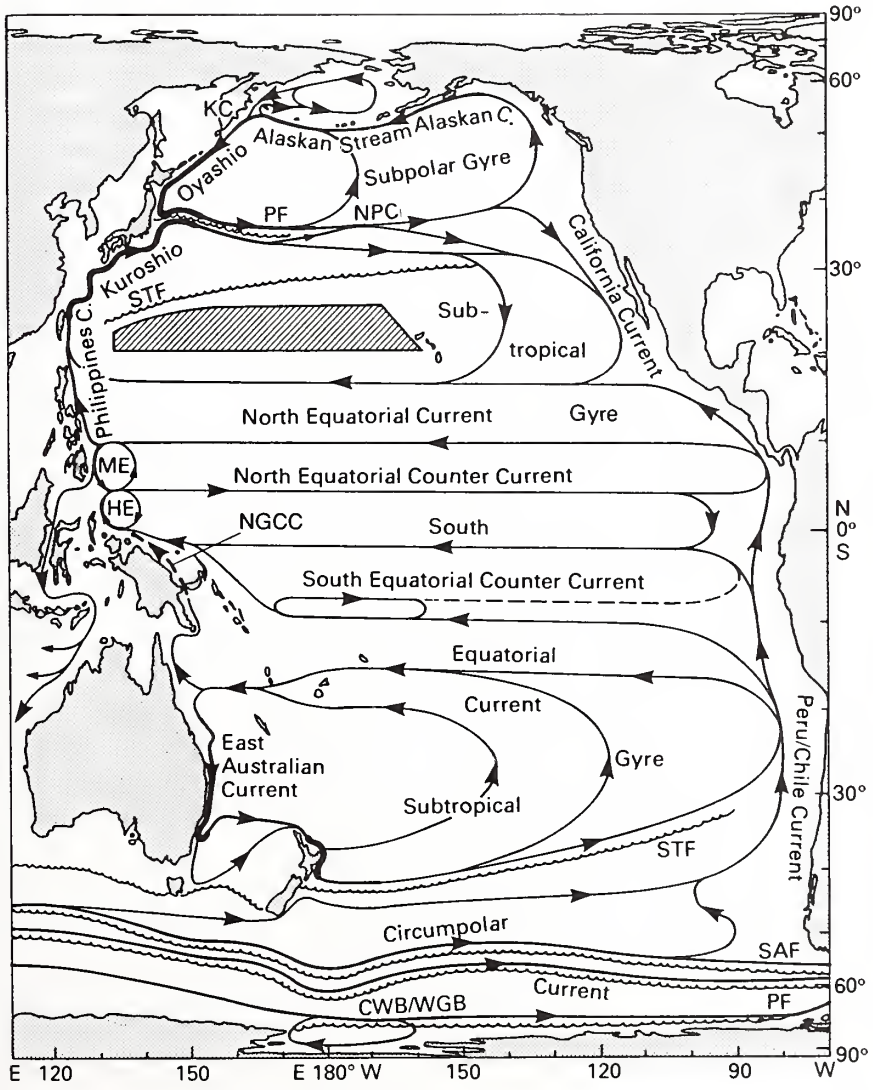

***Figure 10.**--The waters off Colombia are a mixing area for northerly and easterly flowing surface currents. Matthias Tomczak and J. Stuart Godfrey*

Colombian fishermen in recent years have begun to more heavily utilize the available resource. Catches have increased relatively steadily since 1985 from about 70,000 t to nearly 170,000 t in 1995. There have been some declines associated with El Niño events, although modest in comparison to the devastating declines reported by Ecuadorean and Peruvian fishermen. Colombian fishermen, for example, reported a decline of only about 20,000 t in 1992.

Several oceanographic phenomenon appear to adversely affect swordfish abundance off Colombia's Pacific coast. The primary factor may be the relatively high tropical water temperatures (figure 9), although this appears to be

an indirect effect because the species can tolerate a wide range of temperatures. In addition, oceanic currents and resulting thermal fronts are less pronounced off Colombia and in oceanic water to the southwest (figure 11). Upwelling which is weaker along the Colombian coast than off the countries to the south may be another factor (Peru, photo 3). These features are associated with the productivity and aggregation of fodder species. Thus fluctuations affecting fodder species can also contribute to the relatively limited abundance of predator species including swordfish. The shallow thermocline off Colombia and Central America and relatively shallow depths may also affect swordfish abundance.

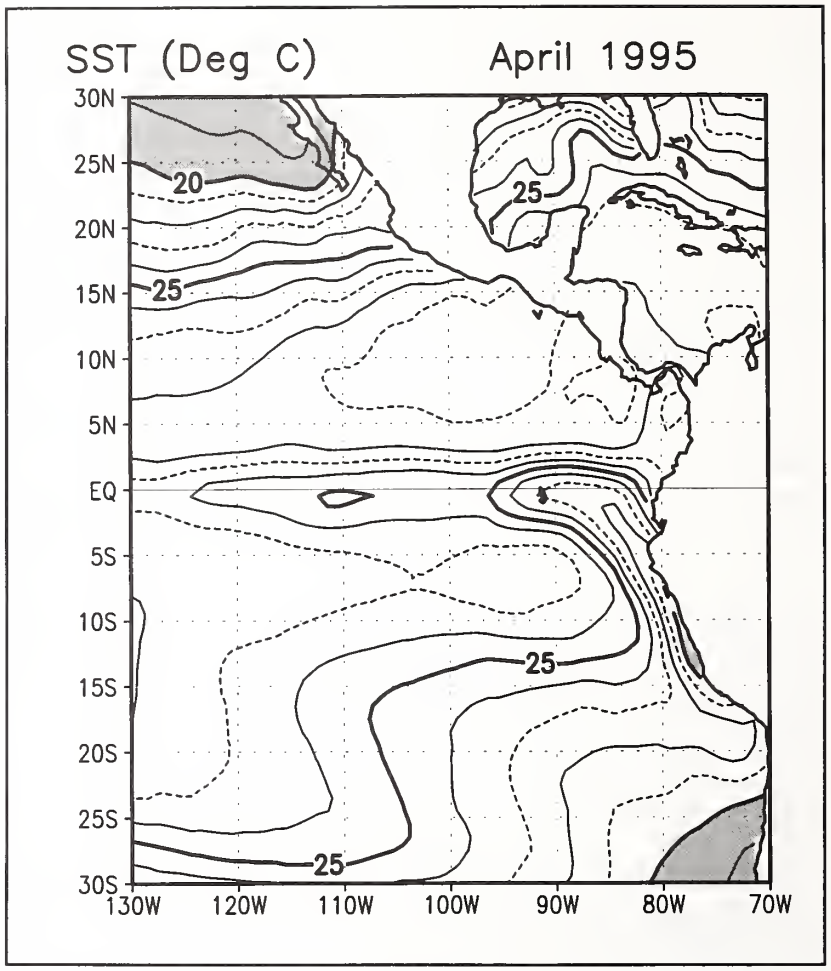

Figure 11.--Thermal fronts are seasonally significant in the equatorial oceanic water off Colombia and Ecuador. The tight isobars shown above suggest the presence of pronounced temperature fronts. Kousky/NOAA

Temperatures: Swordfish generally occur in temperatures from 13°-24°C and have an even wider temperature tolerance, the widest of all the billfish.[98] Temperatures of 23°C appear to be approaching the upper limit of water temperatures in which swordfish can be taken commercially. Researchers stress, however, that swordfish is predominately a mesopelagic species and as a result sea surface temperatures (SSTs) themselves are not a major determinant of species range.[99] The more limited food availability in the warmer water may be the critical factor. SSTs may thus affect the range and abundance of prey, including populations at various depths in the water column. This may be true for both species on which swordfish prey (such as squid or jack mackerel) or species that these prey items feed on (such as anchovy and sardines). Thus there could be an indirect relationship between SSTs and swordfish abundance. Food availability has an obvious potential impact on swordfish distribution. Notably, much of the fishing for swordfish in the Pacific by Japan, the United States, Mexico, Chile, and Australia are at temperate latitudes (north of 20°N or south of 20°S). Chilean fishermen, for example, report the largest catches at 18-42°S.[100] Researchers report the best Chilean results in water of about 16-18°C.[101] This would seem to at least partially explain poor catches in the warmer water off Colombia (figure 9).[102] However, there is substantial fishing in warmer tropical waters of the southeastern Pacific. The Japanese oceanic longline fishery in the area, for example, focuses on tropical latitudes from 5°N-15°S.[103] In addition the historic Peruvian swordfish fishery was primarily conducted off the northern coast at tropical latitudes, about 3-8°S.[104]

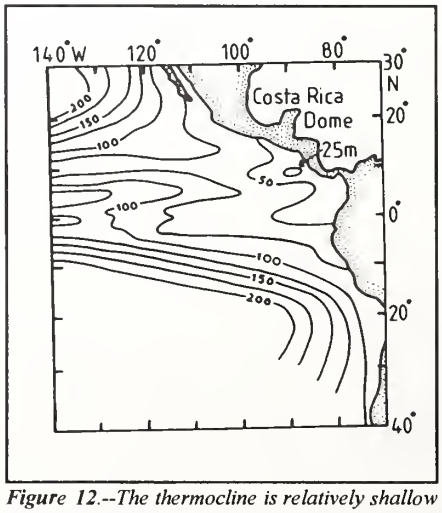

Figure 12.--The thermocline is relatively shallow in the eastern Pacific. It can be as low as 25 m on the Costa Rican dome. Tomczak and Godfrey

Ecuadorean fishermen are currently reporting good catches at latitudes near the equator in waters from 20-23°C.[105] Swordfish can thus clearly be taken in relatively warm tropical waters.[106] Japanese and Ecuadorean catches at tropical latitudes are achieved by setting along thermal fronts which are seasonally pronounced off Ecuador (figure 11). The Peruvian fishery was conducted at tropical latitudes in the Cabo Blanco area, but in water cooled by the Humboldt Current and coastal upwelling. The waters off Colombia, however, appear to be generally warmer than optimal for the species. SST temperatures off Colombia and Central America are normally the warmest in the ETP, usually above 25°C (figure 9). Some researchers dispute even an indirect impact of absolute SST on swordfish. As it is a mesopelagic species the impact of surface temperatures and fronts on its habitat is not well understood.[107] The authors note that very substantial populations of some oceanic pelagics, tropical tunas, are found off Colombia, explaining why fishermen, mostly using purse seiners, heavily target these species (photo 4).

***Photo 4**.--Colombian and foreign fishermen harvest substantial quantities of tuna off Colombia, like these fish delivered to a Cartagena cannery. Armando Hernandez*

Thermal fronts: Swordfish seem to be more abundant in areas with relatively high temperature gradients. Researchers theorize such abundance is linked to habitat or food availability. Water temperatures appear to, at least indirectly, affect the geographic range of the fish, but thermal fronts may be more important in determining the availability of the fish in specific areas.[108] Thermal fronts are most commonly found near upwelling zones, areas where various water masses converge, and current flows. As such thermal fronts and upwelling are less pronounced off Colombia, in part because of the relative weakness of the Humboldt Current, swordfish catches and probably abundance are relatively limited. In contrast, SST maps of the ETP (the area where swordfish are taken to the southwest of Colombia and Ecuador) show relatively tight temperature isobars (figure 11). This suggests pronounced temperature fronts. Interestingly the clustering of catches and high yields in the eastern Pacific appears to have an east-west axis matching the area of important east-west current flows and pronounced temperature gradients (Ecuador, figures 6-8).[109]

Upwelling: Coastal upwelling off Colombia is much less pronounced then off Peru and Chile. The resulting primary productivity thus does not support the massive population of small pelagic species noted further south off Peru and Chile. As small pelagics serve directly or indirectly as fodder species, the populations of some oceanic predators such as swordfish may be affected. The authors note, however, that notable quantities of some oceanic predators like tuna, especially skipjack, are taken in Colombian waters of the ETP.[110]

Thermocline: The thermocline in a large area of the ETP from southern Mexico to northern Ecuador is unusually shallow, less than 50 meters. In some areas, such as the Costa Rican Dome, for example, it can be less than 25 meters (m) (figure 12).[111] Such conditions may not be optimal for swordfish, although the relationship between the thermocline and swordfish is not known.[112] Some researchers do not believe it would affect swordfish abundance.[113] Many fishermen, however, have noted that swordfish tend to aggregate at the thermocline. One U.S. fishermen says that he seeks to "kiss the thermocline" when setting for swordfish.[114]

Other: A variety of other factors such as bottom topography may also affect swordfish abundance. Relatively shallow water combined with a shallow thermocline, for example, may have some affect on feeding. Little definitive information is currently available, although foreign research is addressing this and similar subjects in other areas.[115]

2. Atlantic (Caribbean)

Colombia claims an extensive area of the western Caribbean as a result of its possession of San Andrés and Providencia--as well as other small islands and cays (figure 8). The country claims a Caribbean EEZ of nearly 660,000 square km, although the marine boundary has not yet been delimited with all of the Caribbean countries involved. Great difficulties have been encountered delimiting the marine boundary with Nicaragua and Venezuela.

Several oceanographic phenomenon appear to adversely affect swordfish abundance off Colombia's Caribbean coast. The current structure and other factors such as absolute temperatures, at least indirectly, appear to explain the apparent low abundance of swordfish in the western Caribbean--off both Colombia's mainland coast and offshore islands. The temperature gradients associated with currents in the western Caribbean are much weaker than those associated with the Caribbean Current in the eastern Caribbean as it flows along the Venezuelan coast.[116] Sea surface temperatures (SSTs) in the western Caribbean are the highest generally reported in the western Atlantic. While swordfish are capable of withstanding a wide range of temperatures, prey items are not as common in the warmer water, even at the depths where swordfish forage. Other factors such as the shallow depths in areas of the western Caribbean may also affect swordfish abundance. Some observers stress, however, that the apparent low abundance of swordfish may be due primarily due to limited directed fishing effort.[117]

a. Mainland coast

Colombia's Caribbean coast extends about 1,200 km and is quite varied. Along the Guajira Peninsula in the east, the coast is inhospitable, arid, with low sandy beaches exposed to the sea. Beginning at about Santa Marta, the coast becomes higher and more rocky with many natural inlets. Further south to the Gulf of Urabá and the Panamanian border the coast is subject to heavy wave erosion. Rocky areas separate sandy and muddy beaches and areas of mangrove estuaries. The irregular coast offers many natural ports. There are especially large areas of mangrove estuaries in the Gulf of Urabá. Some coral reefs are found in this area. The shelf is very narrow. Along much of the coast, the shelf extends only about 25 km off shore, but in some areas is somewhat broader--out to about 50 kilometers.

The Caribbean coast is heavily influenced by the Caribbean Current (CC) which primarily flows westward along the coast of Venezuela.[118] While important locally it is relatively weak and unstable compared to more pronounced currents like the Humboldt and Gulf Stream. The CC is diverted from Colombia's mainland coast by the northward projection of the Guajira Peninsula. The CC then continues west to Nicaragua where, upon striking the Central American coast, it divides. Part of the CC forms the Caribbean Counter Current (CCC) which runs south along Costa Rica and Panama before turning east and reaching Colombia. The CCC off Colombia is even less stable than the main CC, with less pronounced temperature gradients. The location and track of the CCC varies seasonally.

b. Caribbean islands

Colombian claims several island groups and cays in the western Caribbean, especially San Andrés (12°N, 82°W) and Providencia (13°N, 81°W). These islands are located on the fringe of the extensive shelf area extending out from Central America (Nicaragua), and are actually closer to the Nicaraguan coast than Colombia's mainland coast. While the small Colombian Pacific EEZ is squeezed by its neighbors, the country has a very considerable Caribbean EEZ. The 200-mile projections from its Caribbean islands mean that Colombia has claim to a huge expanse of the western Caribbean (figure 8).[119] The country's Caribbean EEZ totals 658,000 square kilometers. As a result, the projection of EEZs from Colombia's insular claims means that Panama, Costa Rica, and Nicaragua all have extremely narrow Caribbean EEZs. Some of the western Caribbean areas claimed by Colombia are also claimed by Nicaragua, and disputes over fishing rights occasionally occur. (See "Enforcement".) Colombia's Caribbean EEZ, in addition to the main islands, includes several banks and cays: Albuquerque (12°N, 82°W), Bajo Nuevo (16°N, 78°W), Courtown (12°N, 81°W), Quita Sueño (16°N, 81°W), Roncador (12°N, 80°W), Serrana (14°N, 80°W), and Serranilla (16°N, 80°W) in addition to three submerged banks (Banco Alicia, a bank to the southeast of Serrana, and one east of Courtown). These islands and cays have similar characteristics. They are very low lying with

elevations of only about 20 meters. The shelf falls off along the eastern slope to depths of 1,000-2,000 meters. Many of these islands and cays are fringed by coral reefs.

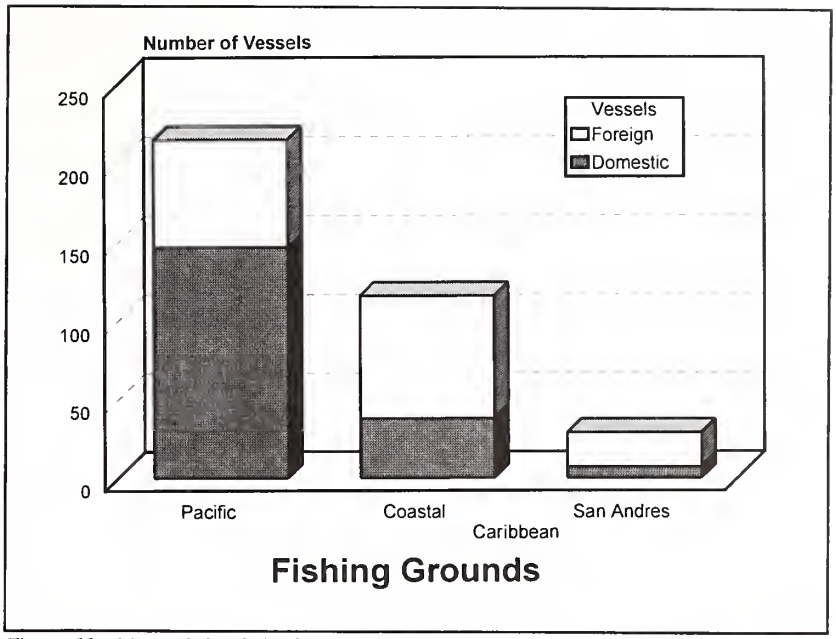

Figure 13.--Most of the Colombian fishing fleet is deployed in the Pacific. Associated foreign vessels comprise a substantial portion of the fleet along both coasts.

The oceanography of Colombia's Caribbean islands, like the mainland coast, is dominated by two currents. The most important is the Caribbean Current (CC), which after running along the Venezuelan coast is deflected northwest by the Guajira Peninsula toward Providencia and San Andrés. The current has a major impact on the islands' climate. The CC flows to the west and then separates after hitting the coast of Central America. The southward flowing branch is the Caribbean Counter Current (CCC). The CC is usually stronger than the CCC with velocities of about 0.5 m per second, except at the beginning of the year (January-March) when the two currents (CC and CCC) divide, producing irregularities in the normal current flow.[120] Water temperatures in the western Caribbean tend to be the highest generally reported in the Caribbean, often approaching 30°C (figure 9).

B. Fishing areas

Very limited information is available to the authors on Colombian fishing grounds, other than a simple Caribbean/Pacific division. Colombia's fisheries catch along the more productive Pacific coast is much larger than in the Caribbean. The Pacific catch in 1994 was three times the Caribbean catch (appendix B1a and figure 2). The deployment of the Colombian fleet reflects the focus on the Pacific (appendix A3b and figure 13). Most of the Pacific catch, however, with the exception of tuna, is low-value anchovy and other small pelagics (figure 3). Over 85 percent of the 1995 non-tuna finfish catch, for example, was composed of small pelagics. Nearly all of the non-tuna commercial catch in the Pacific during 1995, for example, was anchovy and other small pelagics (appendix B1b and figure 3).

Colombian Pacific waters are some of the best tuna grounds in the ETP. Colombian fishermen have developed a major tuna purse-seine fishery and processing industry in recent years. At first the industry relied almost entirely on foreign vessels to supply raw material. Gradually Colombian companies have also acquired some purse seiners (appendix A5b and photo 5). The Colombian tuna catch is primarily taken in the Pacific with purse seines. Very detailed data is available on the grounds fished by the international tuna fleet in the ETP.[121] Colombian Pacific waters are especially productive grounds for skipjack. Colombian fishermen have not, however, developed a commercial tuna longline fishery, although artisanal fishermen do conduct semi-commercial operations for shark (appendix B4) which takes some tunas and billfish. (See "Fleet".)

Colombian grounds along both the Pacific and Caribbean appear to be relatively poor swordfish grounds, although only limited information is available. Some observers believe that the low swordfish catches off Colombia may be more a reflection of the lack of directed fishing than limited abundance.[122] Foreign fishermen do report some swordfish catches on offshore grounds.

Domestic fishermen: Colombian fishermen report no significant swordfish catch. The authors have little Colombian data as the species is not targeted by the local fishermen. Colombian shark fishermen are active, especially along the Pacific coast. Few specific details are available on the grounds fished by Colombian artisanal fishermen targeting sharks with longlines and gillnets.[123] These fishermen conduct semi-commercial operations and report catches of some other oceanic pelagics, including billfish (mostly sailfish and marlin) (appendix B4). Available catch data indicates that most of the billfish is usually taken

on the Pacific grounds (appendix B3c3 and figure 20-22). No information is available to the authors, however, on specific grounds along the coast where the sharks as well as smaller quantities of billfish and tunas are taken. It is known that the shark fishermen operate fairly close to the coast, often in the vicinity of river mouths. (See "Fleet Operations and Gear.") Some estimates suggest that operations are generally limited to 30-50 km and about 10-15 day trips. These fishermen report only rare incidental catches of swordfish along both the Pacific and Caribbean costs. The coastal nature of the fishery is one of the major factors preventing swordfish by-catches.[124] The catches of sailfish and marlin by the shark fishermen suggest, however, that the fishermen might take small quantities of swordfish, if the species occurred in commercial quantities on Colombian coastal grounds. The failure to take even minimal quantities of swordfish as a by-catch could suggest low availability in coastal waters. One observer, however, is unconvinced and does not believe that the absence of swordfish in the billfish by-catch of the shark fishermen provides any useful data on swordfish abundance.[125]

Photo 5.--Colombian companies have acquired several tuna seiners during the 1990s and are no longer entirely dependent on foreigners to supply the new tuna processing industry. A. Hernandez

Foreign fishermen: Japanese longline fishermen do report small swordfish catches off Colombia and some data by large ocean area is available. This data provides some insights into swordfish fishing grounds off Colombia. One study of Japanese longline yields showed relatively low yields off Colombia's Pacific coast. In a few months, however, the Japanese did report moderately good catches in Colombian coastal waters. Generally the Japanese reported better yields to the south and west of Colombia (Ecuador, figure 8).[126] There are also some Caribbean catches. (See "Species: Distribution".) The Japanese vessels operating out of Colombia, however, report minimal swordfish catches, but the target species was tuna (appendix B4 and figure 23).

1. Pacific

a. Colombian fishermen

Colombian Pacific coast fishermen, with a few exceptions, mostly operate close to the coast. Little information is available to the authors on specific grounds, but the species composition of the catch gives some indication as to possible grounds. The essentially coastal nature of the domestic Colombian fishery significantly limits swordfish catches.

Commercial: Colombia's commercial fleet is dominated by the coastal shrimp fleet and new tuna fleet. There were also about 55 other vessels in 1995 targeting other finfish and swordfish (appendix A3b).[127] These vessels take small quantities of dorado and sharks, but rarely swordfish.[128] The Pacific coast commercial fleet conducts some offshore operations, primarily the tuna purse-seine fleet and a small part of the shrimp fleet that is capable of deep-water operations. The bulk of tuna operations are conducted in the Pacific as most of the catch is landed in Buenaventura. Colombian companies have acquired a few large seiners in recent years and are capable of some fishing outside their own EEZ (photo 1). The commercial fishermen also take substantial quantities of small pelagics, anchovy ("carduma)" and other species such as sardines and thread herring. This small pelagic catch is conducted very close to the coast.

Artisanal: Most artisanal fishermen continue to operate very close to the coast. Fishermen targeting shark are some of the few operating at any distance from the coast, and one observer reports that even these operations are only 30-50 km offshore during trips of about 10-15 days.[129] Few details are available as to where along the coast, but the areas off river mouths appear to be favored. The overall species composition of the artisanal fleet confirms largely coastal operations. The fishermen primarily report catches of anchoveta, Pacific sierra, snapper, grouper, seabob shrimp, "pescadilla," seatrouts and corvinas, jacks, "picuda," and catfish, as well as smaller catches of tunas.[130]

Swordfish catches by the artisanal and commercial fishermen are rare, but occasional landings are reported all along the coast, from the Panamanian border south to Gorgona island (3°N,78°W) off the southern coast near Tumaco. Minor catches are also reported off Malpelo Island (4°N, 82°W).[131] The industry representatives interviewed for this study stressed that such swordfish catches are highly unusual. Recreational fishermen also rarely report swordfish. One observer describing Pacific big game fishing for swordfish did not even mention Colombia.[132]

b. Japanese longline fishermen

The only available data on swordfish catches by area has been compiled by foreign longline fishermen. The Japanese, who primarily target tuna, reported only limited swordfish catches off Colombia's Pacific coast (10°N-0°) during the 1990s, but somewhat better results to the west and south in Ecuadorean waters (0°N-5°S) and in international waters outside of Colombian jurisdiction (west of 85°W). Catches to the north off Panama were comparable to results in Colombian waters. The best catches, however were reported well out into the ETP at latitudes off Ecuador and Peru (100°-155°W and 5°N-15°S) and along the Peruvian and northern Chilean coast (75°-90°W and 10°-25°S).[133] A compilation of all distant-water catches shows a similar pattern.[134] Additional Japanese swordfish CPUE data on tuna longlining for a much longer period 1952-85) show relatively poor results along much of the Central American and Colombian coasts (20°N-0°) of only 1 fish per 1,000 hooks. Somewhat better results of 2 fish per 1,000 hooks were noted to the south off the Ecuadorean and Peruvian coasts (0°-20°S). The highest yields off Latin America during this period were achieved off the Mexican and Chilean coasts.[135]

***Photo 6**.--Shrimp trawlers have traditionally been the primary commercial vessels operated from Cartagena and other Caribbean ports. Fred Beaudry*

2. Atlantic (Caribbean)

a. Colombian fishermen

Colombia's overall fisheries catch in the Caribbean is fairly small, rarely more than 15,000 t, although it has been increasing during recent years (appendix B1). Most of the small catch of oceanic pelagics (with the exception of purse-seined tuna), like shark and billfish, are apparently taken along the mainland coast--but swordfish are rarely caught. Some caution must be used when relying upon official catch data. Some observers, for example, have noted billfish landings at San Andrés which were not included in the official catch data.

1) Mainland coast

Colombian fishermen along the mainland Caribbean coast operate primarily in coastal and inshore waters. The commercial fishery has been dominated by the shrimp fishery, although some diversification has taken place since 1992 with the growth of the tuna fishery. The artisanal fishery is more diversified, but generally has been restricted to inshore waters or coastal grounds very close to the coast.

Commercial: Colombia's commercial fishery has primarily targeted shrimp. The shrimp trawlers operate primarily in coastal waters (photo 6). In recent years, a few tuna vessels have been added to the fleet and with the foreign vessels participating in the fishery, tuna now represents more than half of Caribbean catches. INPA reports that in 1995, only six domestic commercial vessels, other than shrimp and tuna vessels, were active in the Caribbean (appendix A3b). All of these vessels, except for the tuna vessels, operate primarily in coastal waters. The commercial fishermen in 1995, with the exception of the tuna purse-seine fishermen, took only about 500 t of finfish and no single species in significant quantity. The only notable species (more than 100 t) besides shrimp and tuna were conch and lobster.[136]

Artisanal: The artisanal fishermen have traditionally conducted operations extremely close to the coast. Artisanal catches in 1995 totaled about 4,000 tons. Until recently the great proportion of the catch was taken in coastal lagoons and other inshore waters. Artisanal fishermen, even those using dugouts, occasionally reported taking sharks of some size (photo 25). The Caribbean-coast artisanal fishermen report taking primarily sharks, snapper, bonito, crab, and lobster.[137] Fishing more than 10 km off the coast is still quite rare. Beyond 15 km, virtually all of the catch is taken by commercial or recreational fishermen.[138] Fishermen operating from Santa Marta (who report separately) were responsible for most of the catch, landing nearly 3,200 t in 1995, mostly "bocon," blue runner, bluntnose jack and other jacks, thread herring, "picuda," and snappers. There were also small shark and tuna caches.[139] The artisanal fishermen report only rare incidental swordfish catches along the mainland Caribbean coast.[140] One observer believes that most of the billfish caught along the mainland coast which INPA reports as having been taken by the artisanal fishermen, is actually caught by recreational fishermen.[141] Available research and reports from domestic and foreign fishermen, as well as recreational fishing activity, all suggest that swordfish catches are extremely limited in the Caribbean.[142] (See "Species: Distribution".) Fisheries for related oceanic pelagic species (sharks and billfish) are mostly conducted in the Pacific, although the pattern fluctuates from year-to-year and occasionally the Caribbean catch is also of some importance (appendices B3a2 and B3b1 and figures 20-22). Detailed information on the specific grounds targeted is not

***Photo 7**--The primitive craft like this dugout ("cayuco") used along the Caribbean coast has restricted the artisanal fishermen to inshore waters. Guerly Avila de Tabares*

***Photo 8**.--While most artisanal fishermen are restricted to inshore waters, some like these snapper longliners operating in the Caribbean may take trips of up to 10 days. Guerly Avila de Tabares*

available. Little domestic longline data is available to the authors. One experimental Caribbean fishing assessment with shark longlines showed no incidental swordfish catches. The lines, however, were set in inshore waters.[143]

2) Caribbean islands

The fishermen on Colombian Caribbean islands report very small catches. They have focused primarily on snapper, grouper, jack mackerel, lobster, conch, and other demersal species taken in relatively shallow water. Oceanic pelagics are rarely reported in official statistics, but there is apparently a small catch--mostly sailfish.[144] INPA reported a small catch of only 70 t in 1995, primarily snapper, lobster, yellowtail snapper, Spanish mackerel, and bluntnose and other jacks.[145] Observers have reported the presence of sharks, tunas, billfish, dorado, mackerels, and other species, although populations may be dispersed and not sufficiently concentrated to support a commercial fishery.[146] Colombian officials have expressed an interest in developing fisheries for pelagic species from the islands.[147] Little progress, however, has been made.

Artisanal fishermen report only occasional incidental swordfish catches around the offshore Caribbean islands.[148] Available INPA data suggests that such catches are extremely limited. INPA reports, for example, virtually no catch of other oceanic species (sharks and billfish) off the islands, but as noted above, catches of some of these species are not being recorded.[149]

b. Japanese longline fishermen

The Japanese have extensively deployed longliners in the Caribbean, primarily for tuna, but they have also reported extensive billfish by-catches, primarily sailfish and marlin.[150] Japanese longliners reported some activity in the western Caribbean during 1993, the latest data available to the authors.[151] Presumably this was primarily fishing in association with Colombian companies, both within and outside Colombian waters. The authors do not have detailed species composition data, but based on conversations with associated Colombian partners, the primary target species was yellowfin tuna and virtually no swordfish was taken (figure 23).[152]

***Photo 9**.--The Bocana deploys driftnets ("malladores") along Colombia's Pacific coast. One of the principal species taken is sharks, but swordfish are rarely reported. Luis Zapata*

***Photo 10**.--Lanchas like this one are replacing the traditional dugouts used by artisanal fishermen. Guerly Avila de Tabares*

IV. Fleet

Colombian fishermen have primarily deployed small artisanal boats, but the commercial fishery has expanded in recent years. Much of the growth has been in the tuna fleet. Colombian tuna fishermen deploy purse seiners. There are no domestic commercial longliners, but some artisanal fishermen deploy small semi-commercial longliners.

A. Artisanal

Colombia's artisanal fishery has traditionally been primarily conducted in inland lakes and rivers as well as coastal lagoons. The small marine artisanal fishery until the 1980s employed mostly primitive "canoas/potrillos/cayucos-botes/bongos-chalupas" (dugout canoes) (appendix A9 and figure 8). Much of the fishing was in fact conducted without boats, using fixed gear, beach seines, and a variety of cast nets. In recent years, artisanal fishermen have acquired more modern vessels ("lanchas"). Some of the fishermen have also initiated semi-commercial operations including longline and driftnet fisheries (photo 4). One of the principal species targeted by the small number of artisanal longline fishermen is shark. The fishermen are not yet taking significant quantities of tuna on their longlines, despite a considerable tuna resource in Colombian waters. The artisanal fishermen report only scattered swordfish catches, but do take some billfish.

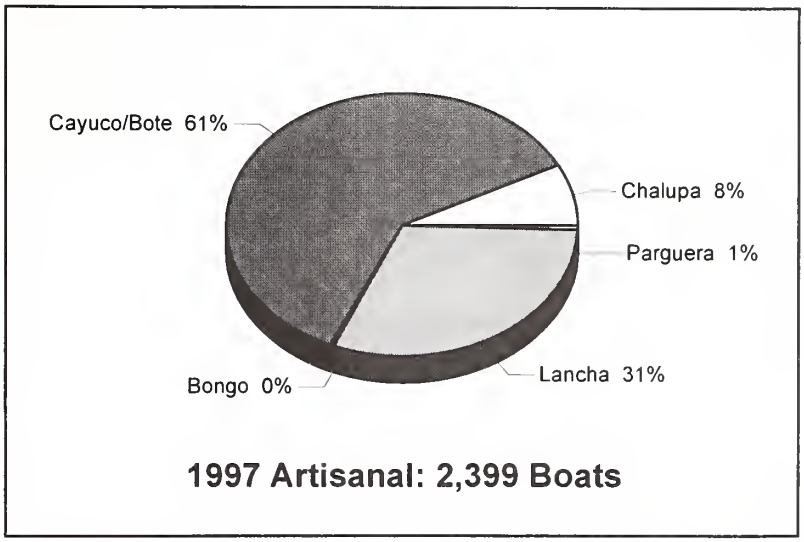

Figure 14--The great bulk of the Colombian artisanal fleet is composed of either "cayucos" or "lanchas".

1. Caribbean

Available historical data show that the artisanal fishermen used mostly small, primitive boats ("cayucos/chalupas/botes"). Almost all the artisanal boats during the 1960s were extremely small and limited to inshore waters, primarily mangrove estuaries and coastal lagoons.[153] A decade later in the late 1970s the situation was little changed. Many of the craft employed were still flat bottom dugout canoes (photo 7 and 11). Few were motorized.[154] The artisanal fleet, however, varied from village to village. The least advanced villages had dugouts, 4.0-6.5 m long. In other villages fishing operations were somewhat more advanced. Some dugouts as long as 12 m were reported. Generally two persons crewed each canoe. In some villages only a few had outboard motors and instead used paddles. In other villages most of the fishermen had outboards. Sails were rarely used. In many cases, the larger dugouts ("bongos") equipped with sizable motors, were used primarily for transport of both people and freight, rather than for fishing.[155] As Colombia's marine fishery has developed, the fishermen have acquired larger boats ("lanchas") and moved into coastal waters. Many artisanal fishermen in the 1980s acquired outboard motors.[156] The modernization of the fleet, however, still lags behind neighboring countries. One local observer reports that Colombian artisanal fishermen still lack large numbers of the speedy fiberglass boats which allow Ecuadorean fishermen to return to port quickly with high-quality fresh fish.[157]

Fishermen in recent years have begun to deploy larger, improved craft. There are currently two general types of artisanal vessels widely used along the Caribbean coasts. These vessels are distinguished primarily by the length of the fishing operations ("autonomía de pesca"):

Day trips: The small Caribbean fishing vessels ("artesanal de costa") are used for short day trips. They generally fish within 8 km of the coast (in bays and other protected areas) and use a variety of fishing gears such as hook and line, gillnets, small longlines (surface and bottom), and traps. Some of these vessels deploy small, mostly bottom gillnets, to target snapper and groupers (photo 16). A few of these small-scale fishermen also occasionally deploy small

***Photo 11.**--Artisanal fishermen deploying a longline in the Pacific. Note the flag and float used to mark the line after the set and the fiberglass "panga" which are replacing dugouts. Luis Zapata*

surface longlines and, to a lesser extent, driftnets.[158]

Cayucos: Coastal and inshore artisanal fishing have traditionally been conducted with flat-bottom dugout canoes ("cayucos") ranging from 5-11 meters. These are still the most commonly used artisanal craft (appendix A9 and figure 14). The dugouts are also referred to as "botes" and the smaller ones as "chalupas" (3-5 m). The majority of artisanal craft in the Caribbean continues to be these small dugouts. They have a fishing autonomy of 1 day and are propelled by small outboard motors, although a few still use paddles and sails.

Lanchas: Fishermen have in recent years begun acquiring more modern boats. The fishermen were reportedly using over 700 lanchas in 1997(appendix A9). Many are constructed of fiberglass ("fibra de vidrio"), but a variety of other materials (wood, wood reinforced with fiberglass, and aluminum) are also used. The launches are up to 11-m long and are all powered by outboard motors. They have a fishing autonomy of only 1 day.

Extended trips: The other major type of artisanal craft is a newer design deployed in the past few years. These snapper launches ("lanchas pargueras") are used on extended trips of about 10 days for the offshore artisanal fishery ("artesanal de altura") (photos 12-14). The vessels are about 8-13 m long with ice holds of 2-4 tons.[159] The vessels are equipped with inboard motors. These mostly wooden vessels are generally manned by about five fishermen which use various hook techniques, including bottom longlines, to target reef fish such as snapper and groupers (photos 12-14).[160] A few of these bottom longliners were rigged for occasional surface longline and driftnet sets targeting sharks and other oceanic pelagics. The fishermen involved, however, have decided to continue bottom longlining for snappers and have generally discontinued their trials with surface longlines.[161]

2. Pacific

Artisanal fishermen are also active along the Pacific coast. Small-scale artisanal fishermen operate cayucos as is common along the Caribbean coast. The most sophisticated artisanal fishermen are those operating about 20 semi-commercial vessels deploying longlines and to a lesser extent driftnets (appendix B4). They include a variety of vessel types and construction materials, both wooden and steel hulls. The authors have received a variety of descriptions of these longliners with some conflicting information. One report indicates vessels of 15-30 meters.[162] Another observer reports that the most common vessels are about 14-16 m long and have capacities of 20-30 tons. They are equipped with inboard motors ranging from 90-150 horsepower. The artisanal longliners have a potential range of about 20-30 days, although most return to port after only 15 days of fishing because they handle fresh fish.[163] Other sources suggest trips of only 10 days.[164] Crews are generally about eight persons.[165] Some vessels serve as motherships towing 10-12 dugouts to the fishing grounds as is the practice in Ecuador. The dugout fishermen, however, do not tend to focus on sharks.[166] (See "Fleet Operations and Gear".) A fleet of smaller 6-m wood boats is based in Tumaco. These vessels make day trips and deploy hand lines and driftnets.[167]

B. Commercial

Colombia's commercial fleet in 1995 consisted of 360 vessels, about 190 domestic and 170 foreign (appendix A1a and figures 15 and 16). A large number of the foreign fishing vessels were from countries registering flag-of-convenience vessels (Panama, Honduras, and Belize), so the actual nationality of the vessels is unclear (appendix A2). Nearly half of the licensed vessels in 1995 were shrimp trawlers (147), but there were also a large number of tuna vessels (82) (appendix A3a and photos 1, 5-6, and 20). Almost all of the tuna vessels are purse seiners.

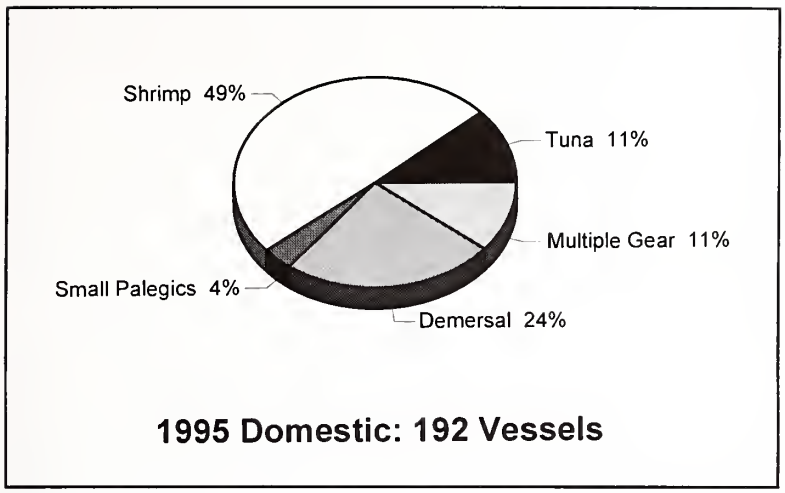

Figure 15.--About half of Colombia's domestic commercial fleet is dedicated to the shrimp fishery.

The Colombian commercial fleet declined sharply from 470 vessels in 1992 to only 330 vessels in 1994 (appendix A1a). Both domestic and foreign vessels were withdrawn from the fleet in 1993. Domestic companies withdrew over 100 vessels and the foreign fishermen withdrew about 65 vessels, but increased the number of vessels somewhat in 1994. Most of the vessels withdrawn were shrimp trawlers, but a substantial number of whitefish and lobster/conch vessels were also withdrawn (appendix A3a). The fleet recovered somewhat to 360 vessels in 1995.

1. Domestic

Colombia has only a modest commercial fishing fleet, the smallest of all the major Latin American countries. Most of Colombia's commercial fleet is composed of relatively small vessels such as shrimp trawlers (photos 6 and 20), although fishermen have begun to expand the fleet somewhat in recent years. As recently as the 1970s the commercial fleet was almost exclusively limited to small shrimp trawlers. The fleet has since diversified and now includes a greater variety of vessels. Fishermen began to significantly expand the fleet in 1992 with the acquisition of larger vessels, mostly tuna seiners (appendix A1b).

The most significant Colombian fleet development has been the acquisition of a modern fleet of tuna purse seiners. Colombia reported three large fishing vessels (500-GRT or larger) to Lloyd's of London in 1992 (appendix A1b). This data is roughly confirmed by the U.S. Office of Naval Intelligence which reported three large Colombian fishing vessels and one research vessel in 1993 (appendix A8a). The fleet has since increased and seven large vessels, all believed to be tuna seiners, were active in 1996 (appendix A5b and A8b).

Current information on the major sectors of Colombia's fishing industry include:

Shrimp: The shrimp trawl fleet is Colombia's most important commercial fleet. The domestic fleet totaled 95 vessels, all but 8 of which operate in coastal waters (appendix A3b and photos 6 and 20). There is no swordfish by-catch.

Tuna: Colombia's domestic tuna fleet totaled about 17-22 vessels in 1995, about two-thirds of which were deployed in the Pacific (appendix A3b and A5a and photos 1 and 5).[168] Most of the tuna vessels operating off Colombia are foreign, but the domestic fleet has been growing in recent years. All of the domestic tuna vessels are purse seiners. Colombian fishermen have yet to deploy tuna longliners. As a result, there is no swordfish by-catch of any importance.[169] At least one company (Océanos), however, is planning to deploy a small longliner in 1997.[170]

Demersal species: Colombia also has a small fleet of vessels targeting a variety of demersal species (referred to locally as "pesca blanca" or whitefish) using lines (appendix A3b). Most of the vessels are deployed in the Pacific. There is no significant

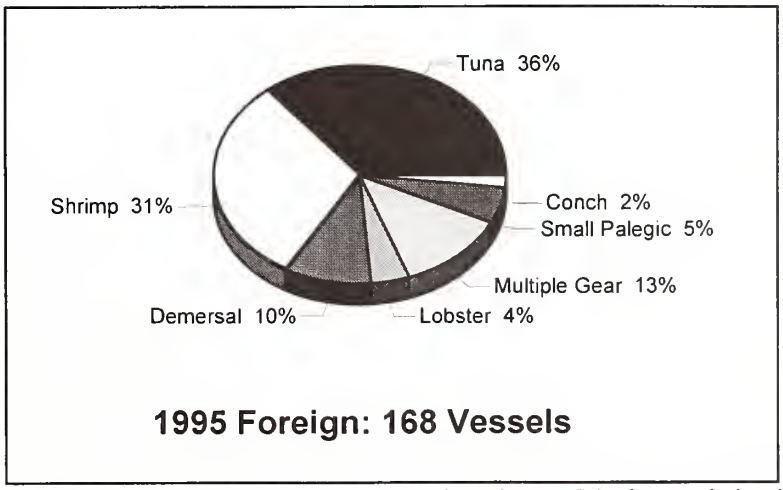

Figure 16.--Over two-thirds of the foreign vessels working in Colombia are deployed in the tuna and shrimp fisheries.

swordfish by-catch.

Longliners: Colombia has no domestic commercial tuna longliners.[171] Artisanal fishermen, however, deploy about 20 semi-commercial longliners for shark along the Pacific coast (appendix B4). (See "Artisanal" above.) While these vessels are classified as artisanal, they in fact conduct small-scale commercial operations. There is a small billfish by-catch, but only an occasional swordfish by-catch.

Others: The commercial fleet is composed of a variety of other vessels, including small pelagic seiners, lobster, and conch boats, and multi-purpose vessels (appendix A3b). There is no significant swordfish by-catch from any of these vessels.

2. Foreign

Many Colombian companies have decided to form associations with foreign vessel owners rather than make the substantial capital investment needed to acquire and operate a modern fleet of vessels.[172] (See "Foreign" below.) This is unusual in Latin America as most other countries have highly restrictive licensing procedures. While it is unclear why Colombia has pursued such a different policy toward foreign fishermen, it may reflect the extremely limited development of a national fishing fleet, even as late as the 1980s. Thus there was no extensive domestic fleet to protect by restrictive licensing policies.

a. Vessel type

Most of the foreign vessels operating off Colombia are shrimp trawlers, but there are also a significant number of tuna vessels as well as a variety of other vessel types. While most of the tuna vessels are purse seiners, there are also a few longliners. Purse seiners do not take significant numbers of swordfish.[173] The Colombian companies associated with the small number of foreign longliners report that these vessels off Colombia also take only small numbers of swordfish.

Tuna: Most of the tuna vessels licensed for operations off Colombia are foreign, although Colombia has been steadily expanding its domestic fleet in recent years. Precise details on vessel characteristics, however, are unavailable to the authors. Colombia issued permits for 64-82 tuna vessels during 1992-1995 (appendix A3a). The foreign vessels in 1995 were about 75 percent of the tuna fleet deployed out of Colombian ports (appendix A3b).

Purse seiners: The foreign tuna vessels deployed off Colombia are mostly purse seiners (appendix A3a and A5b). Vessels flagged in Belize, Cyprus, Ecuador, Honduras, Japan, Korea, Mexico, New Zealand, Mexico, Russia, St. Vincent, Spain, the United States, Vanuatu, and Venezuela participated in the fishery during 1995 (appendix A5b).

Longliners: A few foreign tuna vessels deployed out of Colombian ports are longliners. The authors have, however, received varying estimates of the number of vessels involved. INPA reported that 16 licenses were issued to longliners in 1994.[174] Industry sources report a smaller number. The authors have only been able to identify three companies which currently work with foreign longliners; Bahía Cupica, Pescaderia Asturiana, and COPESNAR.[175] (See "Companies".) Two of these companies have worked for several years with five Japanese longliners, although one was registered in Panama.

Japan: The Japanese are reportedly the principal country operating longliners under association agreements. One company (Bahía Cupica) works with Japanese longliners operating in the Pacific. Another company (Pescaderia Asturiana) works with Japanese longliners operating in the Caribbean/Atlantic. Less is known about the third company (COPESNAR), but unconfirmed reports suggest that it is working with Chinese longliners in the Caribbean (appendix A7).[176] None of the licensed longliners target swordfish. All of the vessels involved are freezer vessels. There are no foreign longliners landing fresh fish. Bahía Cupica reportedly worked with the Japanese longliners *Chiyoda Maru 11*, *Shoei Maru 28*, and the *Chidori Maru 21* during 1997. The company reports that there is no swordfish by-catch.[177] Pescaderia Asturiana worked with two longliners; the Panamanian flag-of-convenience vessel *Victoria 8* and the Japanese *Yushu Maru No. 51*.[178] All five of these longliners are vessels of about 250-300 GRT.

China: The authors have not been able to obtain any details on the two Chinese longliners reportedly working with COPESNAR out of Tumaco (appendix A7). It is possible that they could be Taiwan owned.

Shrimp: Substantial numbers of foreign shrimp trawlers are also licensed, but in 1995 only about one-third the shrimp fleet was foreign vessels (appendix A3b). There is no swordfish by-catch.

Other: Many additional foreign vessels are licensed to purse seine for small pelagics and harvest lobster, conch, and demersal species (appendix A3b). There is no notable swordfish by-catch in any of these fisheries.

b. Country

Fishermen from a large number of foreign countries, both neighboring Latin American countries as well as distant-water fishing countries, deploy fishing vessels off Colombia. Most of the foreign countries are involved in the shrimp and tuna fishery, although a small number of vessels are deployed for small pelagics, finfish, and shellfish (appendix A3b).[179]

The most significant deployment of foreign vessels is for tuna. In 1995 tuna vessels from 15 countries operated off Colombia. Most of the vessels involved were purse seiners. The largest number (26 seiners) were deployed by neighboring Ecuador. Many companies were deploying large, modern purse seiners (Belize, Cyprus, Mexico, Panama, the United States, Vanuatu, and Venezuela). Several of these countries (Belize, Cyprus, Panama, St. Vincent, and Vanuatu) appear to be registering foreign-owned flag-of-convenience vessels.[180]

Belize: Five Belize tuna vessels were licensed in 1995; one was a relatively large seiner, the *Charo* (appendix A5b). Four Belizian-flag seiners were licensed in 1996 (appendix A6c). No details are available on these vessels, but they all appear to be purse seiners or combination vessels. Belize is known to have begun registering flag-of-convenience vessels in recent years.[181] This registration program appears, however, to be relatively small compared to those of Honduras and Panama.

China: Two Chinese-flag vessels worked with the COPESNAR company out of the Pacific-coast port of Tumaco in 1996.[182] The authors believe that the two vessels are longliners, but have not been able to reach the company to confirm this (appendix A6c).

Ecuador: Neighboring Ecuador furnishes the largest number of tuna vessels deployed off Colombia, greater than the number of domestic Colombian tuna vessels. Ecuadorean fishermen in 1995 deployed 26 tuna vessels, all believed to be small purse seiners (appendix A5b). The number declined slightly to 23 vessels in 1996 (appendix A6c).

Honduras: Honduras is a major center for licensing foreign flag-of-convenience vessels. Many of these vessels are tuna longliners, often owned by Taiwan companies.[183] While many Honduran vessels are licensed to fish off Colombia, only one of those vessels in 1995 was a tuna vessel, the *Pampamo I* (appendix A5b). Given the small size of the vessel, it could be Honduran-owned. No Honduran-flag tuna vessels were licensed in 1996 (appendix A6c).

Japan: Japanese companies deployed six tuna vessels off Colombia in 1995. Several are believed to be longliners (appendix A5b and A7). Most of the Japanese vessels operate out of Baranquilla. Japan is the principal country known to be deploying longliners off Colombia. At least one Japanese-owned longliner registered in Panama is also active in Colombia. The number of Japanese tuna vessels in 1996 declined to four (appendix A6c).

Mexico: Mexican companies deployed six tuna vessels off Colombia in 1995. The vessels all appear to be tuna purse seiners, part of the large fleet acquired by Mexico during the 1980s (appendix A5b).[184] Only one Mexican seiner was licensed in 1996 (appendix A6c).

Panama: A total of 14 Panamanian-flag tuna vessels was deployed off Panama in 1995 (appendix A5b). The vessels appear to include small Panamanian seiners as well as foreign-owned flag-of-convenience seiners and longliners. One Colombian company reports working with a Japanese-owned longliner flagged in Panama (appendix A7).[185] The number of licenses granted to Panamanian-flag tuna vessels declined to eight in 1996 (appendix A6c).

United States: U.S. fishermen operated eight tuna vessels in association with Colombian companies during 1995 (appendix A5b). The number of licensed seiners declined to four in 1996, all operating in association with Frigogan (appendix A6c). All of these vessels are large purse seiners, based in Baranquilla and Cartagena. U.S. fishermen deploy swordfish longliners extensively in the Caribbean, but none are known to have sought Colombian licenses and operations in the western Caribbean are extremely limited. U.S. longline fishermen targeting swordfish are also active in the Pacific, but primarily work grounds to the north of the Hawaiian Islands.[186]

Vanuatu: Colombian companies worked with 11 Vanuatu-flagged tuna vessels in 1995 (appendix A5b). The number declined to eight seiners in 1996 (appendix A6c). All of these vessels are believed to be large purse seiners. They appear to be foreign-owned flag-of-convenience vessels and primarily operate out of Cartagena.

Venezuela: Venezuela like Mexico developed a modern tuna purse-seine fishery in the 1980s.[187] Venezuelan companies obtained licenses for 17 tuna vessels in 1995 and 1996 (appendices A5b and A6c). All of these vessels are large, modern tuna purse seiners. The vessels were deployed out of Baranquilla and Cartagena. Venezuelan fishermen also conduct a longline fishery for tuna and swordfish, but association contracts have not been arranged for these vessels.[188]

V. Shipyards

Colombia has only a few shipyards which have given little attention to the construction of fishing vessels. The country's largest shipyard, the Compañía Colombiana de Astilleros (CONASTIL) located in Cartagena, has the capacity to build vessels of up to 10,000 t, and potentially could build tuna seiners and fisheries support vessels. CONASTIL has received technical assistance from Japanese shipyards through a joint venture.[189] The yard, however, is devoted primarily to vessel maintenance and repair. CONASTIL reportedly services a significant number of foreign-flag vessels each year.[190] Small yards in Colombia also provide some support and maintenance services to fishing vessels, mostly shrimp trawlers.

Most Colombian commercial fishing vessels are imported, primarily from the United States.[191] Colombia has also imported small numbers of fishing vessels from Cuba, Mexico, the Netherlands, Spain, and the United Kingdom. Colombia reportedly imported two 850-ton *Atún*-class tuna purse seiners from Mexico in 1989 and 1991.[192] The Colombian Government has facilitated such imports to promote the development of the domestic fishing industry. Under Colombian law, all imports of vessels and equipment are exempt from taxes for 10 years from January 15, 1990.[193]

VI. Fleet Operations and Gear

Colombian fishermen operating artisanal, commercial, and recreational vessels take almost no swordfish, although there is a small incidental catch of billfish. Foreign fishermen targeting tuna report a small incidental catch of swordfish as well as other billfish, mostly in the Pacific.

A. Colombian fishery

Colombian fishermen do not target swordfish. The country's fishermen do not operate any commercial longliners capable of taking the species. (See "Fleet".) The Colombian tuna fishery is a purse-seine fishery which does not take significant numbers of swordfish, even as a by-catch, especially when setting on dolphins.[194] Some of the artisanal operations deploying small longlines and a few driftnets for shark, however, result in limited billfish catches. (Much of this activity is semi-commercial. The dividing line between artisanal and commercial is appears somewhat arbitrary, but INPA has specific guidelines based upon the size of the vessel.[195]) Most of the billfish taken is sailfish and marlin. Catches of swordfish are extremely rare.

1. Artisanal fishery

Colombia's traditional artisanal fishery until recently has been dominated by small-scale fishermen using cast nets ("atarayas"), small seines ("boliches"), gillnets ("transmallo" and "agalleras"), and lines ("lineas") in coastal estuaries, lagoons, and other inshore waters. Some of the nets were woven by the fishermen themselves. Fixed gear ("estacas"), traps ("nasas" "trampas"), bottom longlines ("palangre"), and small beach seines ("chinchorros") were also used.[196] The small number of fishermen venturing off the coast rarely went more than 2-3 kilometers. These fishermen mostly used handlines, fishing at a depth of 10-40 meters. The fishermen deployed a few gillnets, taking sierra and associated species such as tarpon ("sábalo") and shark. A few longlines ("palangre"), light attraction ("atracción luminosa"), and lines ("ciempiés") were also used. The light attraction method resulted in some catches of bigeye scad.[197] Much of the fishing was conducted from isolated coastal villages. Poor landing facilities and transportation links made it very difficult for the fishermen to market their catch and generate sufficient income to modernize operations.[198]

Some modernization of the fishery occurred during the 1970s, but appears to have been highly localized. Through the 1980s, much of the artisanal fishery was still very primitive.

Caribbean: Various reports suggest that fishermen in the Guajira Peninsula and near Santa Marta were the most advanced.[199] Even off the Guajira, however, the fishermen operated mostly on the shelf which is extremely narrow, only up to about 10 km off shore, using hand lines.[200] One report indicated that by the late 1970s the fishermen had begun targeting snappers a little further off the coast on the shelf slope. Further south, a variety of inshore fisheries for shellfish (shrimp and mollusks) were more important.[201] Given such operations, artisanal swordfish catches were unlikely, especially as the species does not

***Photo 12**--These fishermen are setting bottom longlines for snapper and grouper in the Caribbean. Guerly Avila de Tabares*

***Photo 13**--These artisanal fishermen operating from a lancha have baited their hooks for a longline set. Guerly Avila de Tabares*

***Photo 14**--Retrieving the catch from a bottom longline set along the Caribbean coast. Guerly Avila de Tabares*

***Photo 15**.--Driftnet fishermen set their nets at dusk and retrieve them at dawn. The mesh used in the Pacific varies from 5-10 inches. Gilberto Acevedo*

***Photo 16**.--A small surface gillnet used by artisanal fishermen along the Caribbean coast off the Guajira Peninsula. Guerly Avila de Tabares*

***Photo 17**.--An artisanal purse seine about to be deployed from a small lancha. colombian fishermen are increasingly moving out of inshore waters. Guerly Avila de Tabares*

***Photo 18**--Artisanal longline fishermen taking dorado (mahi mahi/dolphin) along Colombia's Pacific coast. Julio Cesar Casquete*

appear to be abundant off Colombia.

Pacific: The authors have been able to find little historical information on artisanal fishing along the Pacific coast. One observer describes a fleet of about 50 artisanal boats operating from Tumaco. They make day trips landing small sharks and seasonally (May and August) tuna with hand lines and driftnets. The fishermen are able to target tuna during those two months as the fish reportedly often come into coastal waters. Occasional billfish and swordfish are sometimes taken, but such catches are infrequent.[202]

Colombia's marine artisanal fishery has expanded significantly in recent years, albeit from a low base. This, in part, is reflected in the increased Colombian fishery catches achieved during the late 1980s and 1990s (appendix B1a). Only limited information is available to the authors, however, on the current status of the artisanal fishery.[203] Artisanal fishermen in the Pacific do employ small longlines and driftnets and may, as a result, take very limited numbers of swordfish incidentally. Artisanal fishermen in the Caribbean have been more reluctant to diversify, but INPA has conducted some research to demonstrate possible results to the fishermen. One recent study assessed the possibility of using shark ("tiburón") longlines to diversify Caribbean operations which are mostly handlines and driftnets. The study was conducted by INPA's Proyecto de Pesca Artesanal Marítima and consisted of test fishing during 1992-93 along the Caribbean coast to compare three different gears. Notably no catches of swordfish and other billfish were reported.[204] Fishing operations vary significantly, depending on the gear used by the fishermen. Virtually no swordfish is taken by the artisanal fishermen, but they do take some billfish (appendix B3c1-2 and figures 17-19).

Driftnet: Some artisanal fishermen conducting semi-commercial operations along the Pacific coast deploy small driftnets ("malladores"), varying from 0.6-1.5 km in length.[205] The primary target species are sharks (appendix B4).[206] Driftnet trials have been conducted in the Caribbean. The nets ("red de enmalle") evaluated were about 180 m long and about 13 m deep. They were generally deployed at 5:30-8:30 am and left active for 14-15 hours.[207] The principal species taken by the driftnets was snappers and relatively small quantities of pelagic species such as king mackerel ("sierra"). The shark catch was especially small.

Bottom longlines: Caribbean coast fishermen extensively deploy bottom longlines from their lanchas pargueras, primarily from ports along the

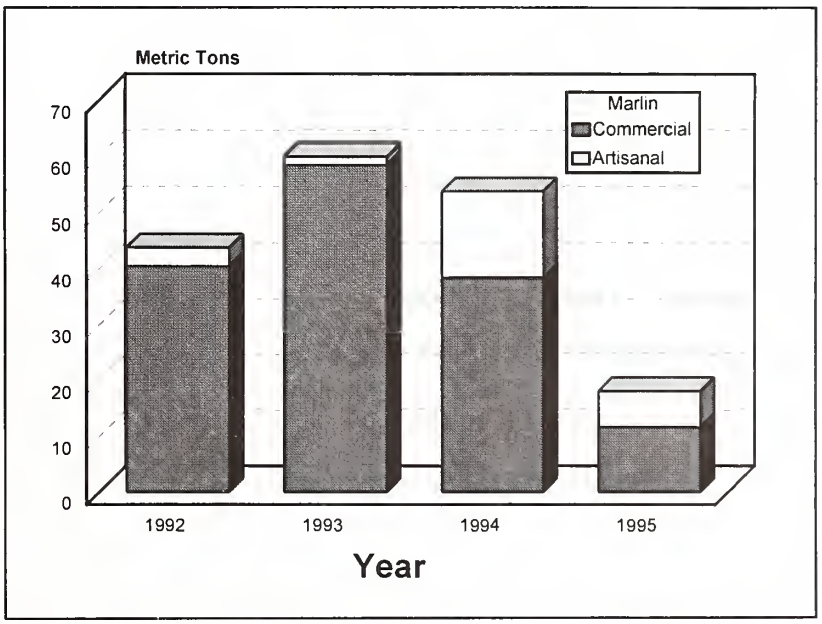

***Figure 17**--Most of Colombia's marlin catch is landed by commercial fishermen.*

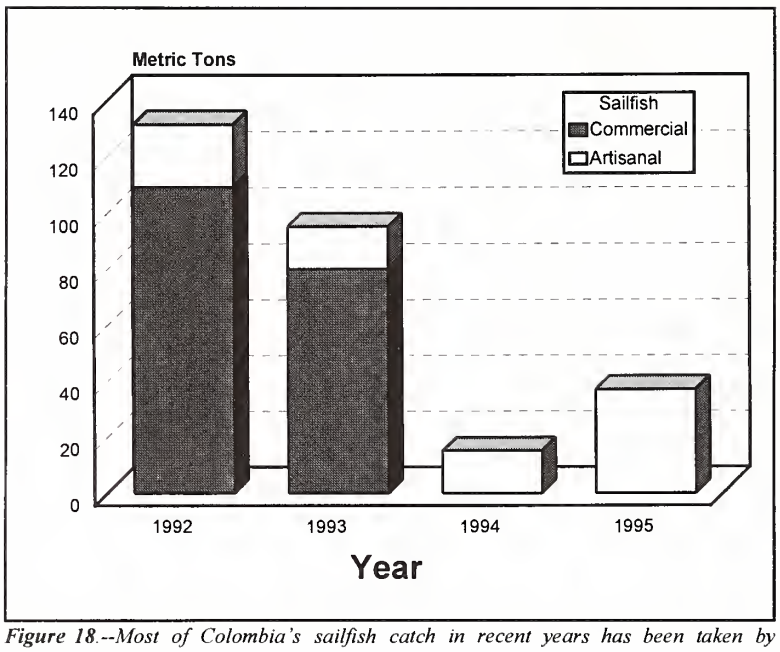

Figure 18.--Most of Colombia's sailfish catch in recent years has been taken by artisanal fishermen.

Guajira Peninsula. Their longlines have up to 1,200 hooks separated by almost 2 m and extend about 2 kilometers. The fishing autonomy (trips) of these vessels is about 10 days. They fish generally in upwelling regions off the Guajira Peninsula. The Colombian bottom longliners have adopted the techniques developed by Venezuelan fishermen for snapper and grouper. Some of these vessels also deploy "ballestillas", which are manual lines with two-five hooks at the tip of the line. They have a metallic leader at the end to enhance the sensation of fishing bites for the fishermen.[208] The Colombian fishermen have been slow to adopt more modern gear to target other species (such as surface longlines for sharks and billfish).

Surface longlines: Artisanal fishermen deploying surface longlines targeting sharks are active primarily along the Pacific coast.[209] Normally about 75-90 percent of Colombia's shark catch is taken in the Pacific, although occasionally (1993) the Caribbean catch approaches the Pacific catch (appendix B3b1). Some sources suggest that sharks are primarily taken by artisanal fishermen, but INPA reports catches by both artisanal as well as small-scale commercial fishermen (appendix B3c1-2).

Pacific: Both small-scale and larger semi-commercial operations are conducted in the Pacific.

Small-scale: Small-scale artisanal fishermen using cayucos and other small craft, deploy longlines of about 150 meters. Vertical hook lines are spaced about every 5 meters.[210]

Semi-commercial: One report indicates that 22 artisanal (semi-commercial) longliners were active during 1997 (appendix B4). They operate about 30-50 km offshore with crews of about eight persons. The fishermen target areas where river flows mix with seawater ("hileros"), looking for lines of debris at the surface to set their nets. The setting and retrieval of the line is quite similar to Ecuadorean operations.[211] The Colombian longline fishermen deploy 300-1,500 hooks baited with fish, squid, or eel. There is no significant swordfish by-catch, but a few fish are occasionally reported. Most of the vessels are based in Buenaventura and all of the catch is marketed fresh domestically.[212] Another report indicates that the fishermen deploy lines 4.5-9.0 km long with

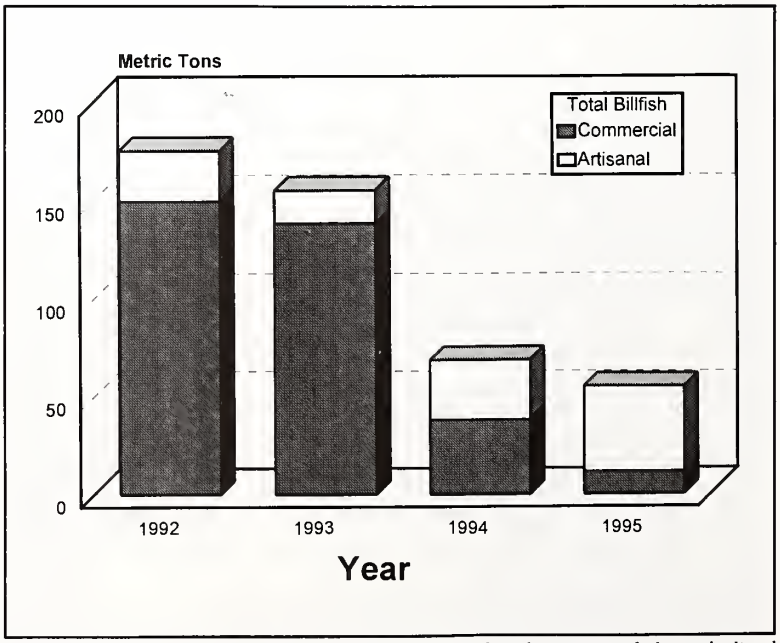

Figure 19.--Colombian billfish catches, both artisanal and commercial, have declined sharply in recent years.

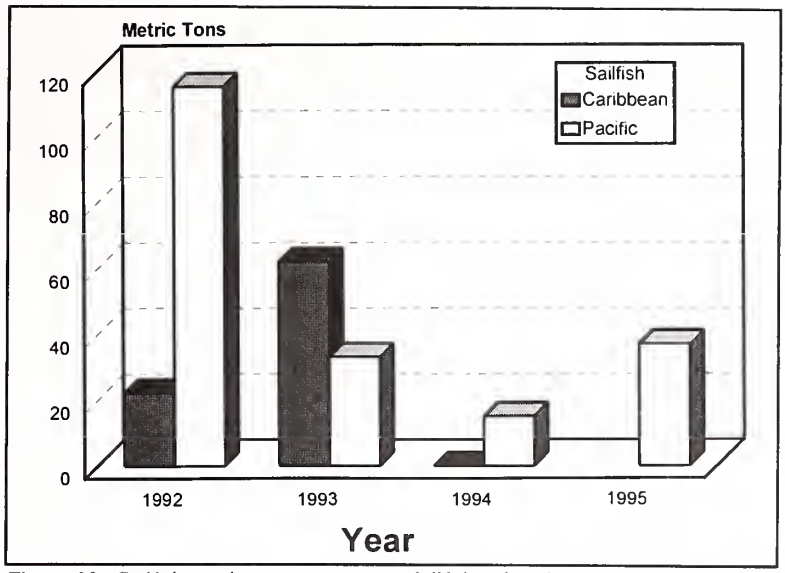

***Figure 20**.--Sailfish is the most important billfish taken by Colombian fishermen. Catches are usually reported primarily in the Pacific.*

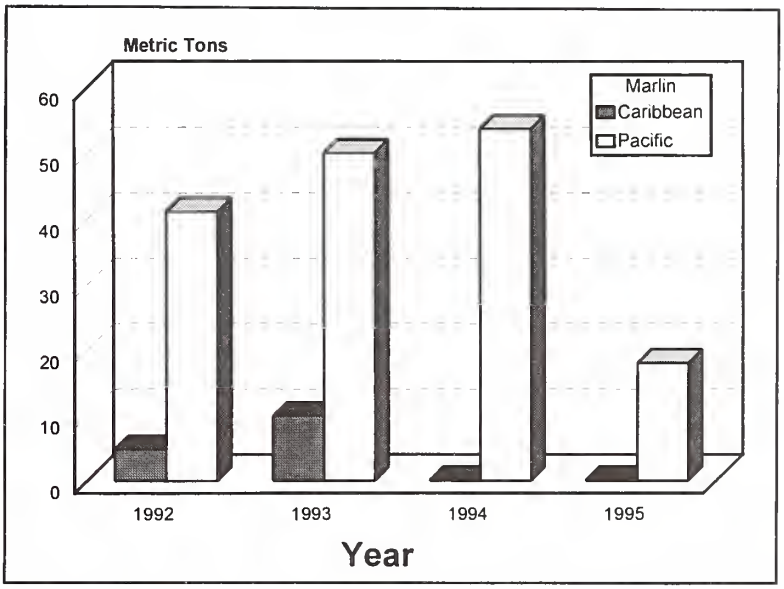

***Figure 21**.--Colombian marlin catches dropped sharply in 1995. Most of the catch is landed in the Pacific.*

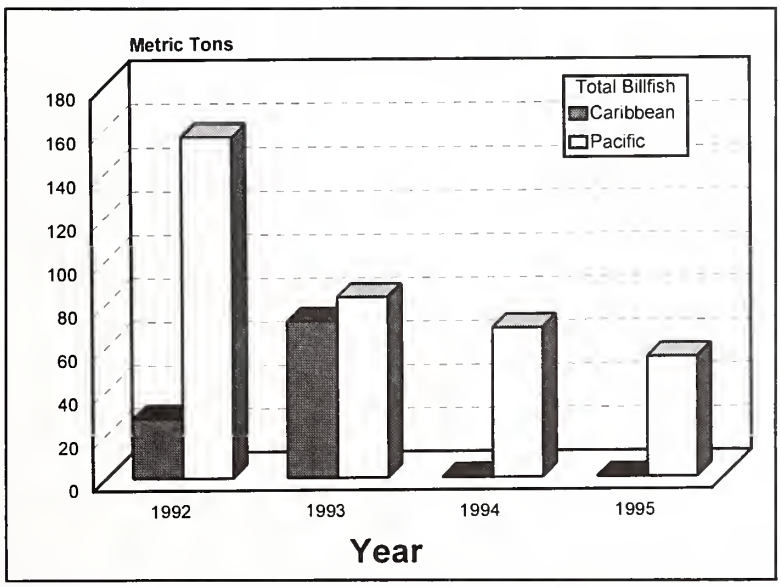

***Figure 22**.--Most of Colombia's billfish is taken in the Pacific, but particularly poor Caribbean catches were reported in 1994-95.*

500-1,000 hooks. They set the vertical hooks lines about every 9 meters. Observers provide somewhat varied accounts on the catch composition. One observer reports that the catch is primarily shark and dorado.[213] Another reports sharks (tinto and bravo) as well as jack crevalle and tunas (yellowfin, skipjack, and bigeye). The vessels usually make trips of about 10 days, but may stay out longer if catches during the first few days are poor.[214]

Caribbean: Some test longlining has been done in the Caribbean. In one study the longlines deployed were about 270 m long and have 30 vertical hook lines spaced at about every 9 meters. They were generally deployed at 3:00-7:45 pm and brought in from 4:10 am-7:15 am. The average soak time left active in the water was 13 hours. The catch varied significantly seasonally, but substantial quantities of sharks were taken, especially smalltail shark (*Carcharhinus porosus*).[215] In other trials, a boat captain using surface longlines in the Taganga region near Santa Marta reported deploying 1 km longlines with about 100 hooks spaced at intervals of 10 m and setting the hooks at depths of about 20-30 meters. The fishermen used 8-m fiberglass vessels with a hold capacity of 1.5 tons and equipped with inboard motors of 20 horsepower. The four-man crews deployed the longlines twice per day (morning set/midday haul and early afternoon set/late afternoon haul). Each set was 3 hours long. They used thread herring ("machuelo") as bait. The fishermen took 3-day trips and took tunas, sierra, dorado, sharks, sailfish, and marlin which they marketed fresh in Taganga. They did not, however, take any swordfish. The main line of the longline was a 3/16 in polypropylene, and the vertical lines("reinales") were made out of 200-lb-test (91 kg) nylon. No swordfish was taken during the 3-month trial period.[216] The Caribbean fishermen appear hesitant to shift to surface longlines, despite the excellent results achieved in test fishing. Most have considerable experience with traditional bottom longlines targeting snapper (photos 12-14) and grouper and are hesitant to shift to surface longlining.[217]

Hook and line: The principal fishing gear for many small-scale artisanal fishermen is hook-and-line, often basic hand lines. Fishermen in larger boats also deploy other hook and line systems. The catch can be quite diverse and vary significantly by grounds and seasons. One Caribbean gear study using handlines as a secondary gear complementing longline and driftnet sets reported taking primarily bigeye scad ("ojo gordo"). Much lesser quantities of snappers, groupers and other demersal fish were taken. Very small quantities of pelagics such as king mackerel and sharks were also reported.[218] Much of this fishing is conducted in relatively shallow inshore waters where swordfish catches would be unlikely. Most of the fishing for finfish from Colombia's offshore islands uses hook and line.[219]

2. Commercial fishery

Commercial fishermen in recent years have launched a tuna fishery using purse seiners to supply domestic canneries and export markets. There is no significant swordfish catch reported in this fishery.[220] Artisanal fishermen in the Pacific are conducting semi-commercial longline operations for shark which takes some billfish, but rarely swordfish (appendix B4). (See "Artisanal" above.) INPA reports a commercial shark and billfish catch in the Pacific (appendix B3c2). Colombia's billfish catch is in most years is landed primarily by the commercial fishermen (appendix B3c3 and figure 19). It is, however, unclear to the authors as to gear and operations involved.

3. Recreational fishery

The authors have been able to find very few references to sport fishing in Colombia. U.S. fishermen attempting to develop a South American sport fishery during the 1930-50s generally showed little interest in Colombia.[221] A U.S. Embassy report in 1977 noted that there was very little sport fishing.[222] The situation does not appear to have changed measurably.

Pacific: Few references to Pacific big game fishing have been found. While swordfish is rarely caught, artisanal and commercial catch data suggest that sailfish and marlin are taken (appendices B3c1-2 and figures 20-22). A local source reports that some sport fishing occurs in the Pacific and that there are several international billfish tournaments. The most popular location is Bahia Solano along the northern coast.[223]

Caribbean: There appears to be more sport fishing activity along the Caribbean coast. This is probably due to larger Caribbean ports with a more developed tourist infrastructure and greater number of recreational boats. The authors have been able to find a few references to Colombian sport fishing in the Caribbean. Some sports fishing is conducted from the Caribbean islands like San Andrés, but billfish are generally not targeted. Some big game fishing is also conducted along the mainland coast. Colombia's big game fishing for billfish in the Caribbean occurs mostly out of Cartagena, Santa Marta, and Baranquilla.[224] One source reports that the Cartagena Club de Pesca hosts tournaments.[225] Both marlin and sailfish are taken. Based on artisanal and commercial catches, billfish appear much more abundant off the Pacific coast (appendix B3c1-2 and figure 22), but this may or may not reflect actual abundance.

B. Foreign vessels

The primary foreign fleet operations for oceanic pelagics is the purse-seine fishery for skipjack and yellowfin. Fleet operations in this fishery have been described in detail by other authors, but are not relevant to this study as the incidental catch of swordfish is so limited.[226] Unlike other billfish, swordfish do not school and thus cannot be taken in any quantity by purse seiners which are designed specifically to set on schools.

Foreign longline operations are much more limited than the massive purse-seine operations. Only a few licensed foreign vessels are longliners (appendix A6a-b and A7). The authors have, however, received varying estimates on the actual number of vessels involved. The primary country deploying longlines in tuna operations off Colombia is Japan. Countries involved to a lesser extent are Panama and China (and possibly Taiwan through flag-of-convenience registrations). At least one of the Japanese longliners has a Panamanian flag-of-convenience registration. Some Chinese longliners reportedly obtained licenses in 1996. Crews aboard the Japanese longliners can average about 22-23 persons. Only a minimal amount of swordfish are taken by these foreign vessels, and it is caught incidentally to directed tuna operations. Operations off Colombia appear to be similar to overall Japanese longline operations.[227] One basic difference between the operations of foreign vessels associated with Colombian companies and normal highseas operations is that the vessels operating in association with Colombian companies are required to land their catch at Colombian ports. (See "Transshipments".) Some basic data on grounds, catches and yields by area, and seasonality of the Japanese fishery are discussed above in "Species" and "Fishing Grounds."

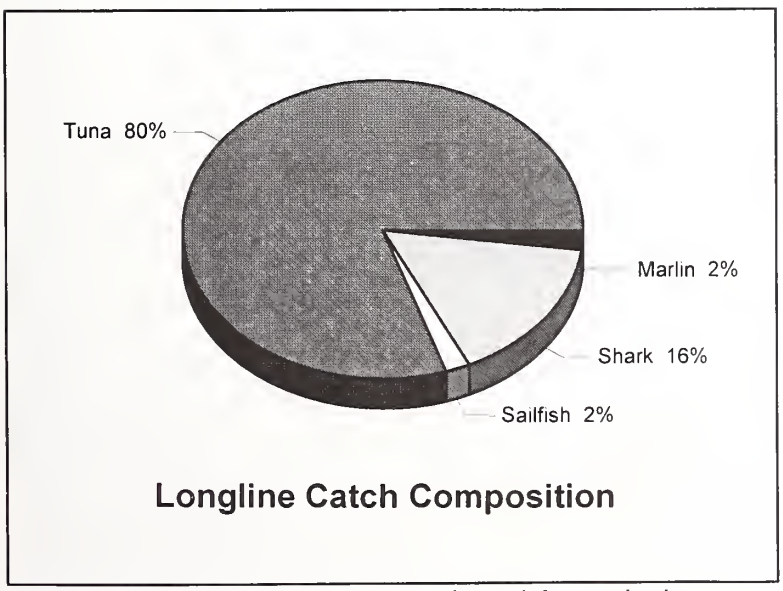

***Figure 23**--One of the Colombian companies working with Japanese longliners reports that tuna comprise most of the catch and almost no swordfish is taken.*

A few foreign longliners are active in both the Atlantic/Caribbean and Pacific off Colombia.

Both oceans: One Cartagena company reports working with two Japanese longliners during the late 1980s. The vessels were deployed in both the Pacific and Caribbean/Atlantic. Trips averaged 80-90 days and about 120-150 t of tuna and 30-35 t of by-catch, mostly sharks, were landed.[228]

Caribbean/Atlantic: Another Cartagena-based company reports that the associated Japanese-owned vessel (flagged in Panama) is deployed in the Atlantic during the winter/spring (December-May) and in the Caribbean, within and outside Colombian waters, during the summer (June-November). The shifting grounds follow the migratory movement of the fish. Trips may be up to 60-90 days and the vessels average about 4-5 trips per year.[229] The vessels deploy mainlines about 150 km long. Each set deploys about 3,000 hooks approximately every 50 meters. A sardine-like species is used for bait and it is purchased from Ecuador or Japan rather than obtained locally. Hooks are set at depths of about 50 meters. The line is deployed during the early morning and retrieved at dusk, although occasionally they do the opposite.[230]

Pacific: Colombian companies working with Japanese longliners reports that tuna comprises 80-85 percent of the catch. Most of the remainder (10-16 percent) is shark (appendix B4 and figure 23). There are small sailfish and marlin catches, but virtually no swordfish. The tuna catch is shipped to Japan, but most of the by-catch, including small quantities of billfish, dorado, and sierra are marketed domestically.[231] (See "Markets".) Another company reportedly worked with Chinese longliners out of Tumaco during 1996, but no details are available (appendix A6c). Colombian law requires that fishing crews generally be Colombian nationals, even on the foreign vessels fishing with Colombian licenses.[232] The regulations, however, are apparently not always enforced strictly.

Some limited information is available on the contractual relationships and the crews of the foreign vessels.

Positions: The captains and engineers on the Japanese vessels are Japanese. Colombian law requires the licensed vessels to have at least one Colombian crew member. Procedures vary from vessel to vessel. Colombian sources

complain that some of the foreign vessel operators will hire one Colombian in a non-technical capacity (for instances a cook) and then fill the other positions with foreigners.

Recruitment difficulties: Some of the Colombian companies working with associated foreign vessels report that the foreign vessel operators claim that they have trouble recruiting Colombian fishermen because of cultural differences, trip duration, working conditions, and living accommodations.[233] They report that cultural differences and long trips appear to be especially important factors making it difficult to recruit Colombian fishermen.[234]

Nationalities: Crew members are mostly non-Colombians, although this varies from vessel to vessel. The crew is commonly Japanese (usually the more technical positions), Latin Americans (especially Ecuadoreans and Panamanians), and Indonesians. A company working with three Japanese longliners reports that there are various Ecuadorean and Colombian crew members on the *Chiyoda Maru 11*. However, on the other two vessels (*Shoei Maru 28* and the *Chidori Maru 21*) there are only one on each (not necessarily a fisherman). A company working with Japanese vessels (*Victoria 8* and *Yushu Maru 51*), albeit one flagged in Panama, reports crews of Colombians, Japanese, and Indonesians.[235]

Commercial arrangements: The commercial arrangements involved vary. A common practice is for the Colombian company to provide the fuel, water, provisions, repairs, operating costs, and crew salaries. These costs are then subtracted from the amount received for the fish when the catch is landed.[236]

Earnings: Colombian regulations do not address salaries aboard the foreign vessels. Each company arranges payment terms with the crew directly. According to a spokesman at Vikingos, the largest Colombian fishing company, individual companies generally have standard arrangements. Vikingos' crews receive 15 percent of the total value of fish at time of sale. This 15 percent is divided as follows: 45 percent to the captain, 17 percent to the machinist, and the remaining 38 percent to the crew (on average, four per ship). The by-catch is traditionally the property of the crew, and is divided however the crew sees fit.[237]

Crew exchanges: Colombia is reportedly not used for crew exchanges.[238] This is somewhat surprising given the substantial number of foreign vessels being licensed.

The foreign vessels are a potential source of data for INPA. Regulations currently require a Colombian observer during the experimental fishing operations, but after that, no fisheries observer is required.[239] Many of the purse seiners, however, carry dolphin observers.

VII. Catch

Available data suggest that significant quantities of swordfish are not normally harvested off Colombia (appendices B2a and B3a1 and figure 24). The few individuals occasionally taken are harvested as a by-catch.[240] For unknown reasons, an unusual swordfish catch of 29 t was reported in 1991. Artisanal, commercial, and sport fishermen report shark and small billfish catches--mostly sailfish and marlin (appendix B3a1-2).[241] The relative importance of the artisanal and commercial billfish fisheries varies from year to year (appendix B3a2). The largest billfish catches during most years are reported in the Pacific (figures 22). Other sources report, however, that there is no significant catch of swordfish or billfish because the commercial harvest of these species is prohibited.[242] (See "Government Agency and Policy.") Presumably the billfish and small quantities of swordfish are incidental by-catches. There are no INPA regulations limiting by-catch levels.[243]

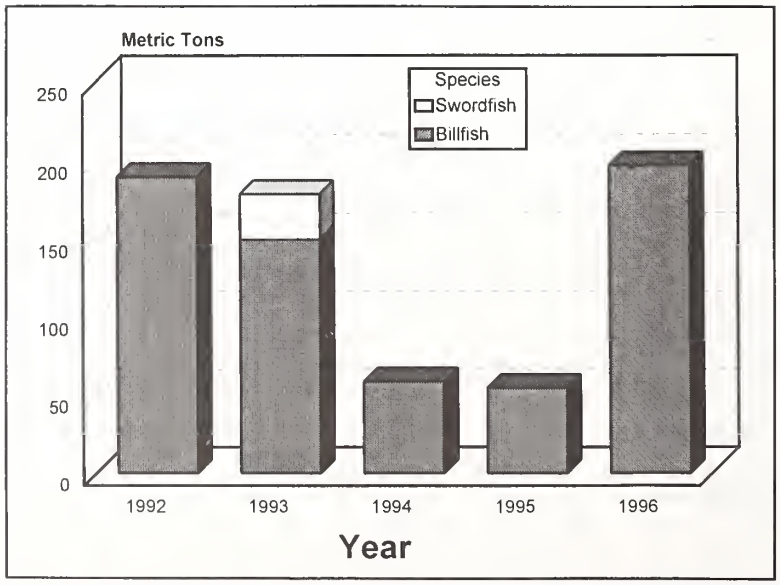

Figure 24.--Colombian fishermen normally report no measurable swordfish catch, although billfish are caught.

Only limited data is available on the annual catch fluctuations of oceanic pelagics. Domestic fishermen targeting oceanic pelagics, with the exception of the tuna purse-seine fishermen, primarily focusing on sharks. They report

***Photo 18A**--Artisanal driftnet fishermen took this 22-kg swordfish ("puercito") along Colombia's southern Pacific coast, about 100-km west of Gorgona Island. Such catches are rare. G. Acevedo*

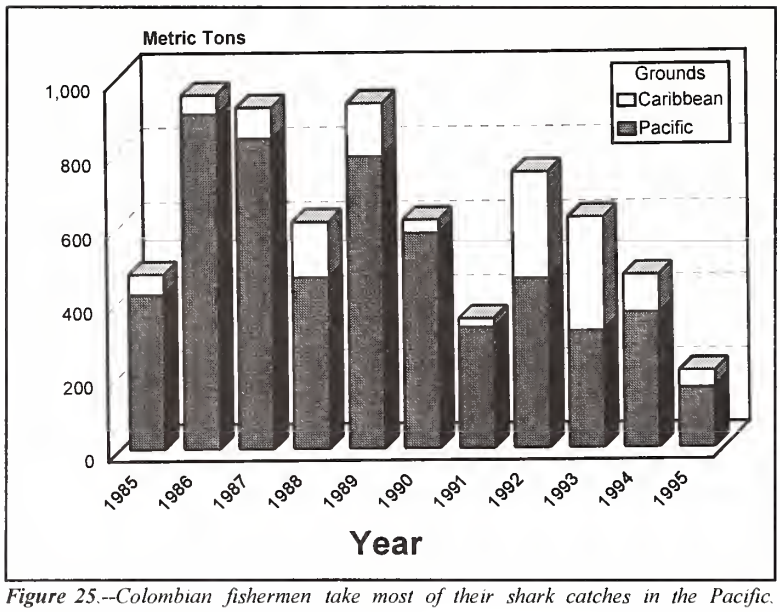

Figure 25.--Colombian fishermen take most of their shark catches in the Pacific. Catches have declined sharply since 1992.

virtually no swordfish, but their shark and billfish fisheries have fluctuated sharply in recent years. Foreign fishing vessels report their catches to INPA, but this data is not published. Given the limited swordfish catch data available, the authors have also turned to trends in other oceanic pelagic fisheries.[244] In addition import fluctuations in major target markets are used as an additional source of information on annual developments in the Colombian fishery.

1985-89: The Colombian shark longline fishery caught a record 955 t in 1986 (appendix B3b1 and figure 23). Good shark catches were also reported in 1987 and 1989. Pacific catches were 75-90 percent of the total. Billfish and swordfish (mostly billfish) exports to Japan were relatively high totaling 77-89 t in 1986-87, but dropped to only 24 t in 1989 (appendix E4a1).

1990-91: Shark catches declined sharply in 1990, totaling only about 620 t and a mere 350 t in 1991 (appendix B3b1). Caribbean catches declined to especially low levels. Colombia's only reported swordfish catch was taken in 1991 and totaled 29 t (appendix B2a). Billfish exports to Japan continued at low levels; 36 t in both 1990 and 1991 (appendix E4a1).

1992-93: The shark catch improved in 1992, reaching 745 t (appendix B3b1). Caribbean shark catches were unusually high. The 1993 Caribbean catch was only slightly below that taken in the Pacific. Colombian fishermen also reported billfish (sailfish and marlin) catches of 150-190 t in 1992-93 (appendices B3a1-2). Small quantities of swordfish were exported to the United States during 1992-93 (appendix E3a-b). Shipments of billfish and swordfish to Japan were unusually high, totaling 156 t in 1993, but the amount of swordfish in those shipments was probably relatively small (appendix E4a1).

1994: The shark catch declined to less than 470 t in 1994 (appendix B3b1). Despite the lower shark catch, sharkfin exports to the United States increased (appendix E3c). The billfish catch also declined by over 50 percent to 60-70 t in 1994 (appendix B3a1-2). The decline in the Caribbean billfish catch was particularly notable. These fluctuations appear to reflect the withdrawal of vessels and overall catch decline reported in 1994 (appendix B1a). Billfish exports to Japan dropped to only 22 t (appendix E4a1).

1995: Results in 1995 showed some conflicting trends. The overall fisheries catch increased sharply in 1995 (appendix B1a). Despite the overall increase, the shark catch continued to decline to only about 210 t (appendix B3b1). Sharkfin exports to the United States, however, reached record levels (appendix E3c). Billfish catches stabilized somewhat, but catches of about 55 t were still lower than in 1994 (appendix B3a2). Despite the lower billfish catch, billfish exports to Japan increased to 35 t (appendix E4a1).

1996: Few details are available on 1996 results. Tuna shipments to the United States fell precipitously (appendix E3f), but this was product from the purse-seine fishery. Most of the decline was due to the smaller shipments of loins. No fresh longline-caught tuna was shipped. Shark fin shipments to the United States continued at high levels (appendix E3c). Billfish exports to Japan increased sharply to 55 t (appendix E4a1).

VIII. Ports

Colombian ports have had limited facilities for fishing vessels because of the relatively small size of the domestic fleet. Although still of only minor importance, a few small artisanal longliners operate, mostly from Pacific ports. The small artisanal longliners deployed in recent years for sharks operate from Buenaventura and Tumaco. It is these vessels which land much of Colombia's billfish, shark, and other large pelagic catch.[245] Port facilities have been expanded in recent years, primarily because of the need to handle the large number of foreign vessels that currently operate out of Colombian ports. Facilities for artisanal fishermen have also been improved.

Colombian ports (primarily Buenaventura and Cartagena) are now extensively used by the foreign tuna vessels leased by Colombian companies (appendix A5b). Foreign fishermen can obtain basic port services including fuel and supplies. Maintenance services are available in Colombian shipyards.[246] The recent development of a tuna purse-seine fishery has primarily been centered at the Pacific port of Buenaventura, although some effort has been deployed from Tumaco and other ports as well. Colombian and foreign vessels landed over 40,000 t of tuna in 1995, nearly 80 percent of which was landed at Buenaventura.[247] While most of Colombia's tuna purse-seine catch is landed and processed at Buenaventura, smaller quantities are also landed at Caribbean ports, especially Cartagena (photo 19). (See "Processing and Products.") The authors note that a substantial number of purse seiners operate out of Baranquilla, especially the U.S. seiners (appendix A5b). The small number of foreign longliners appear to be using primarily Cartagena and Buenaventura (appendix A7).

***Photo 19**--Cartagena is Colombia's principal Caribbean port. Traditionally the principal commercial fishery was for shrimp, but there is now an important tuna industry.*

Available information on Colombian fishing ports is as follows:

Bahia Solano: The Japanese in 1988 reportedly agreed to help build a small fishing port at Bahia Solano along Colombia's northern Pacific coast. About 80 percent of the $15 million project was to be financed by the Japanese.[248] Bahia Solano is one of the more popular locations for sport fishing.

Baranquilla: Several tuna loining and canning operations are conducted from this Caribbean port (Atunec and FRIGOGAN) (appendix C2). There is also some limited sport fishing.

Buenaventura: Buenaventura is Colombia's principal Pacific port, but one of the country's poorest cities. This port is a major export center for coffee, cereals, and seafood. An industrial and commercial free zone is located next to the port facilities. It is the principal home port for Colombia's tuna purse-seine fleet and is a major center for tuna loining operations (appendices A5b and C2). Buenaventura is also the home port for most of the commercial fishing fleet operating along the Pacific coast (appendix A6b). The Colombian Government initiated efforts to build a modern $30 million fishing port at Buenaventura in 1978, but after many attempts the plan was shelved in 1985. Funds were obtained in the mid-1980s for a $150-million port improvement project which was completed in 1988. The channel was dredged, piers extended, new warehouses built, and equipment purchased.[249] The Corporación Regional del Valle de Cauca in 1989, sought to attract foreign investment for further improvement.[250] The new fishery facilities included basic port infrastructure, piers, ice plant, fueling facilities, a repair yard, and facilities for artisanal fishermen. The modern port facilities for both artisanal and commercial fishermen were scheduled to be opened in 1991.[251] The first modern tuna plant was opened in 1989 by COPESCOL.[252] The COPESCOL plant, however, closed in 1995. (See "Companies".) The ARPECOL and CIMAR plants at Buenaventura are still operating. Perhaps 150 small artisanal craft are

longlining from this port.[253] The fishermen, however, report dwindling catches and a serious pollution problem.[254] INPESCA works with the domestic longliners (appendix B4). While most of the tuna landed in Buenaventura is unloaded by purse seiners, the Bahia Cupica company also works with a small number of Japanese longliners (appendix A7).

Cali: COPESCOL and CIMAR processed tuna in this Pacific-coast port (appendix C2). The COPESCOL plant closed in 1995.

Cartagena: Cartagena is the Colombia's major Caribbean port (photo 19). The Colombian Government and private investors during the early 1980s made major improvements to the port, including a 8,000 ton synchrolift drydock, a 5,000 t cold store, and new repair shops.[255] The Fondo de Desarrollo Rural with Dutch assistance in 1988 helped fund the construction of improved facilities for artisanal fishermen costing about $1 million.[256] Cartagena has for years been the center of Colombia's Caribbean shrimp trawl fishery (photo 20). Several tuna loining and canning operations are conducted from this Caribbean port (Atunes de Colombia, COPROMAR, EXPLOPESCA, FRIGOPESCA/Vikingos, and Industrial Pesquera C/Biana) (appendix A5c). The principal Vikingos plant is also located in Cartagena. There is some limited sport fishing. While most of the tuna landed in Cartagena is unloaded by purse seiners, the Pescaderia Asturiana company also works with a small number of Japanese longliners (appendix A7).

Photo 20.--Cartagena is Colombia's most important shrimp port and the species dominated the local industry until the initiation of tuna processing in the 1990s. Fred Beaudry

Tumaco: This port is located along the southern coast, close to the Ecuadorean border. Local development agencies in 1987 began planning for a fisheries complex for both artisanal and commercial fishermen.[257] The Colombian Government in 1989 promoted the construction of a new fisheries complex.[258] Various press reports described a complex totaling 22,000 square m, and extensive piers. CIMAR has a tuna plant at this Pacific-coast port (appendix C2). One report indicated that Tumaco is the home port for most of the small artisanal longliners operating along the country's Pacific coast.[259] Available INPA data suggests that most of the Pacific artisanal shark catch was landed in Tumaco during 1993-94, but only about half in 1995 (appendix B3b2). One local observer describes a fleet of about 50 small wood boats, most of which are about 6 meters. The vessels land small sharks and seasonally (May and August) tuna. Only occasional billfish or swordfish are taken.[260] Very little of the commercial shark catch, however, is landed in Tumaco. The fishing port at Tumaco is administered by a non-profit company, COPESNAR. Profits from the port are invested in maintaining and expanding it, the new Escuela Técnica de Pesca, and other social projects. COPESNAR is currently planning a new tuna cannery and loining facility.[261] Unconfirmed reports indicate that COPESNAR was working with two Chinese longliners out of Tumaco in 1997 (appendix A7).

IX. Transshipments

Colombia is a major transshipment point for the international tuna fleet operating in the ETP. INPA has the authority to authorize the transhipment through Colombian ports of tuna and tuna-like species taken by vessels fishing under Colombian licenses.[262] Only vessels with Colombian licenses are allowed to transship through Colombian ports. The foreign-caught tuna being transshipped is fish taken by the international purse-seine fleet. These operations, however, are not the simple transfer of unprocessed frozen product. Most of the foreign-caught fish is being landed in Colombia for value-added processing into loins and thus are not precisely transshipments. The authors know of only limited transshipments and they are limited to fish taken by small number of foreign longliners associated with Colombian companies (appendix A7). The companies involved report that most all of the foreign-caught catch is tuna and the foreign vessels are reportedly catching almost no swordfish (appendix B4 and figure 23).

A. Foreign fishing fleet

Colombia does not permit foreign tuna vessels operating without a Colombian license to transship through Colombian ports. Details on foreign fleet operations, within and beyond Colombian waters, not in association with Colombian companies are covered in the various other country chapters of this study.[263] The Japanese are the principal distant-water country catching swordfish off the western coast of South America (Latin America, appendix C2b). Most of the Japanese catch, however, is transshipped at sea rather than bringing the fish into nearby ports. This allows the Japanese to avoid the complications and cost of entering foreign ports as well as enabling more control over the handling of the product.[264] One 1994 Japanese press report, however, indicated that Japanese fishermen were transshipping tuna and other species caught off Colombia and Ecuador through Central American ports, but provided few details.[265]

B. Associated vessels

Colombia does permit foreign vessels associated with Colombian companies to transship their catch.

Purse seiners: Most of the tuna shipments through Colombia are fish caught by foreign-flag purse-seine fishermen who desire to unload at ports close to the fishing ground so they can remain in the region and continue fishing. Much of the product involved, however, are actually not transshipments. Many companies are taking advantage of the opportunity for low-cost loining at the large modern plants that have been opened during recent years (appendix C1-2). (See "Processing and Products.") Because of the value added this product could be considered a Colombian export rather than a transshipment.

Longliners: The Government also licenses a few longliners. The vessels are nominally leased to Colombian companies, but the fishing operations are entirely in the hands of the foreign company and captain and the while the tuna catch is shipped through Colombian ports, unlike the purse-seine catch, it is not processed by the Colombian partner. Information on the operations of the small number of longliners involved is limited, but available reports suggest minimal quantities of swordfish are taken.

Japanese vessels: Five Japanese-owned longliners in 1997 were operating with Bahia Cupica and Pescaderia Asturiana out of Buenaventura and Cartagena (appendix A7). One Colombian company reports that almost all of the catch is tuna, up to 85 percent of the total. The predominant species is yellowfin. Most of the remaining by-catch is shark and a very limited amount of sailfish and marlin and a variety of other species, but only an occasional swordfish (appendix B4 and figure 25).[266] The catch of these vessels, however, is not formally transshipped. The foreign longliners associated with Colombian companies are all required to land their catch in Colombia. It is then either exported or marketed domestically by the associated Colombian company. The associated longliners (mostly Japanese or affiliated with Japanese companies) are not permitted to transship at sea. The catch is all landed in a Colombian port. The Colombian company does not handle or process the tuna. The tuna catch is immediately loaded aboard a refrigerated cargo vessel ("trampero") for shipment to Japan. The Japanese fishermen sell the tuna to the associated Colombian company at prevailing international prices.[267] The Colombian company then formally sells the tuna to Japanese buyers, although the Japanese vessel owner provides the market connections and thus largely arranges the sale of fish in Japan.[268] The by-catch of other species, including small quantities of swordfish and billfish, is delivered to the Colombian partner. Most of the by-catch is marketed domestically.[269] Only limited information is available on the financial arrangements and contracts between the Colombian and Japanese companies. (See "Fleet Operations and Gear.")

X. Processing and Products

The principal seafood processing conducted in the 1970s-80s was packing frozen shrimp (photo 21). The industry has diversified somewhat in recent years. Several large companies operate modern plants producing high-quality product (photo 22). Colombia has since the late 1980s developed a substantial tuna processing industry. Products include canned tuna and fresh and frozen tuna loins.[270] High labor costs in the United States and Europe have created strong demand for low-cost production of loins.[271] Foreign canneries find it cost-effective to have the labor-intensive processing of loins done in Colombia. Seven companies operating from major Caribbean and Pacific coasts have installed a significant capacity to both loin and can tuna (appendix C1-2).

Colombian companies do not process high-quality sashimi-grade seafood such as swordfish and tuna.[272] The limited landings of swordfish explain why swordfish is not being processed. It is less clear why Colombian companies are not processing high-quality fresh and frozen tuna. No Colombian company as of mid-1997 was producing fresh or frozen sashimi-grade seafood, despite the country's substantial tuna resource. The tuna landed by both Colombian and foreign tuna seiners is targeted for loining and sale to foreign canneries. Purse seiners do not land fish with quality standards suitable for sashimi or other high-end product forms. The large Colombian companies operating the tuna canning and loining facilities are not participating in the expanding trade to supply high-quality fresh and frozen tuna to export markets. No Colombian company has deployed its own commercial longliners which would be capable of producing sashimi-grade tuna. A few companies (Antillana, COAPESCA, Océanos, and Pescaderia Asturiana), however, have had trials or are considering possible longline operations in the future. Some companies, like Pescaderia Asturiana, are convinced that Colombia has the potential to support a commercial longline fishery and are looking for possible foreign partners.

Only a few companies (Bahia Cupica, COPESNAR, and Pescaderia Asturiana) are working with foreign longliners. The catch, which is mostly tuna, is not processed by the Colombian companies. Colombian sources report that the frozen H&G trunks are exported without further processing to Japan.[273] Japanese statistics, however, report imports of small quantities of billfish fillets (appendix E4a2 and figure 29). It is unknown who is producing these fillets. It is possible that some are produced aboard the vessel.

***Photo 21.**--Colombian companies have been steadily improving quality standards during the 1990s, partly due to the significant expansion of the shrimp and tuna industries. Armando Hernadez*

Colombian companies are processing billfish and sharks landed by domestic fishermen. Much of the country's shark catch is filleted and marketed in the country's larger cities. The billfish by-catch (sailfish and marlin) of the shark fishery and dorado longline vessels is also filleted and sold through the same marketing channels.[274] (See "Markets".) The marlin, as it is wider, is sometimes cut into steaks, although it is also filleted. The more slender sailfish are most often filleted, although some are sold as gutted trunks.[275]

***Photo 22.**--Several companies like Vikingos in these photographs have high-quality processing standards and modern equipment. Alfonso Morales*

XI. Companies

A. Trade associations

The Colombian Chamber of Commerce (Asociación Nacional de Industrias, ANDI) has a specialized fisheries affiliate, the Cámara de la Industria Pesquera (CIP). The CIP was established in March 1993 with the goal of promoting the country's fishing industry. The CIP seeks to promote the integration of the fisheries sector, coordinate international initiatives, improve the quality of exports, and encourage the enactment of sound fishery laws. The CIP is composed of Colombia's six largest fishing companies (Antillana, Atunec, Atunes de Colombia, Frigogan, Océanos, and Vikingos) which include the major tuna exporters. These members account for 98 percent of the country's tuna exports, 65 percent of the country's shrimp exports, and 100 percent of the lobster and conch exports.[276]

B. Companies

Colombian fishing companies during the 1970s-80s focused primarily on the shrimp fishery. The few large companies mostly targeted the export market. The industry has since expanded and diversified. Many well-capitalized firms have entered the industry and participate in a much wider range of activities.

Shrimp: Shrimp companies operating trawlers or processing the trawl catch (Antillana, ARPECOL, COAPESCA, INPESCA, Océanos, and Vikingos) began to diversify during the 1980s. Several gave increasing attention to marketing the finfish by-catch. A few of these companies (Océanos and Vikingos) opened shrimp farms.[277] Many new companies entered the shrimp aquaculture industry. Some of the processors (INPESCA and Vikingos) also market the finfish catch of the artisanal fishermen. Several of the established processors as well as a few new ones (Bahia Cupica) work under association agreements with foreign fishermen to obtain raw material. Most of the vessels involved were trawlers, but a few companies also worked with longliners.

Tuna: Several new companies (ATUNCOL, ATUNEC, CIMAR, COPESCOL, FRIGOGAN, and FRIGOPESSCA/Vikingos) have opened in recent years to participate in the new tuna industry. These companies have focused on the production of frozen loins and canned product. (See "Processing and Products".) There are currently seven tuna processing plants (appendix C1), located along both the Caribbean and Pacific coast. At first these companies worked with foreign tuna seiners under association agreements, but a few companies have since acquired their own vessels. Some companies (COAPESCA and Pescaderia Asturiana) have conducted or experimented in longline trials to supply fresh tuna, but no Colombian company has yet succeeded in establishing regular operations supplying oceanic pelagics. One company (Océanos) in 1997 was converting a shrimp trawler for longline operations.

Other finfish: Some companies in the early 1990s began to take advantage of the high prices in export markets for fresh finfish. Shipments of high-quality fresh product from marine fisheries to the United States, for example, more than doubled from $1.7 million in 1992 to $4.0 million in 1993 (appendix E3d). Most of this product was grouper and other species taken in demersal fisheries. Resource and other problems have adversely affected these fisheries. Shipments of fresh marine product, however, declined to only $0.8 million in 1996.

None of the new tuna companies process high-quality fresh product or sashimi-grade frozen product. As there is no commercial swordfish catch, these and other companies do not handle swordfish. It is not clear, however, why they are not handling fresh tuna. Colombian exports of fresh tuna have been very limited and no tuna at all was exported to the United States since 1992. Shipments of other oceanic pelagics (shark, dorado, and other species) declined sharply in 1996. Most of the fresh finfish exported to the United States in 1976 was actually farmed tilapia (appendix E3c). There is some shipment of billfish to Japan which may include some swordfish. The quantity involved has exceeded 150 t (1993) (appendix E4a1). This appears to be fish landed in Colombia by Japanese longliners and then exported frozen to Japan by the associated Colombian company.[278] The Colombian companies working with longliners, however, insist that they are not exporting billfish to Japan.[279] Bahia Cupica, COPESNAR, and Pescaderia Asturiana appear to be the principal companies involved, but a few other Colombian companies may be working with Japanese longliners (appendix A7). Frigopesca reportedly was also involved, working with Pescaderia Asturiana.

Available details on individual Colombian companies is as follows:

Antillana: This Caribbean-coast company is one of the larger Colombian fishing companies. The company in the early 1990s reportedly assessed possible longline operations, but decided against it.

ARPECOL: Armadores Pesqueros Colombianos (ARPECOL), located in Buenaventura, was established in 1974. The company is primarily involved with shrimp processing and exporting. It does not own vessels, but instead has association contracts with 18 domestic and foreign trawlers in 1997. Company officials are attempting to diversify operations because of Colombia's declining shrimp catch. ARPECOL did some tests on loining tuna in 1994, exporting about 80 t to a Spanish company. They have decided to pursue tuna loin processing and are currently installing the needed equipment. ARPECOL, which has not yet negotiated extensive association contracts with tuna vessels, reports they have held preliminary discussions with Colombian and Ecuadorean purse-seine operators to obtain raw material. One contract was negotiated with an Ecuadorean owner in 1996 to operate the *Don Celso* (appendix A6d). The company also processes other finfish, primarily the finfish by-catch of the shrimp trawlers. They do not handle swordfish.[280]

Asturiana: See Pescaderia Asturiana.

Atunes de Colombia (ATUNCOL): This large Cartagena company processes tuna loins. They reportedly packed about 60,000 t in 1994 (appendix C1). The company is a major operator of foreign vessels, working with 18 foreign tuna vessels in 1995 (appendix A5c) and 13 seiners in 1996 (appendix A6d). In addition to three of its own vessels, the company works with Vanuatu and Venezuelan seiners. ATUNCOL exports through its affiliate, Seatech. Company representatives do not desire to publicize their operations and declined to provide the authors with information regarding their fishing operations.[281] They are not believed to be working with longliners.

ATUNEC: Atunes y Enlatados de Caribe (ATUNEC) is one of the larger Colombian fishing companies. It is located in Baranquilla and produces both canned and frozen tuna products. The company can process about 100 t of tuna daily (appendix C1). The company worked with eight foreign tuna vessels in 1995, but only one in 1996 (appendix A5c and A6d). They are not believed to be working with longliners.

Bahia Cupica: This Buenaventura-based company was established in 1992. It is a vertically integrated company involved with fishing, processing, and exporting operations. The company has its own shrimp trawl fleet and it is associated with other trawlers and three Japanese longliners. Total annual production in 1996 was 800 t shrimp and 400 t of finfish ("pesca blanca").[282] Nearly 90 percent of the shrimp ("gambas") is caught in deep water and exported to the European Union as frozen heads-on product. Some of the white shrimp is exported to the United States. The finfish is obtained from the three Japanese longliners that work in association with the company. These three longliners have been affiliated with the company since its establishment in 1992. The 200-240 NRT longliners are *Chiyoda Maru 11*, *Shoei Maru 28*, and the *Chidori Maru 21* (appendix A6d).[283] The Japanese longline fishing trips are about 60 days. The crew composition varies on the vessels. The *Chiyoda Maru 11* employs some Ecuadoreans and Colombians, but the other two longliners have few Colombian crew members. (See "Fleet Operations and Gear: Foreign".) The target species is tuna, which is frozen and stored at -60°C. It is transshipped at Buenaventura directly to a freezer boat ("trampero") which transports the fish to Japan. Bahia Cupica does not handle or process the catch destined for the Japanese market. All the tuna is theoretically sold to Bahia Cupica, although the Japanese vessel owner plays a major role in marketing the fish. Tuna makes up over 80 percent of the longline catch, mostly yellowfin and small amounts of bigeye (appendix B4 and figure 25). The resulting 15 percent by-catch is primarily shark (about 80 percent). There are small sailfish and marlin catches, but virtually no swordfish catches. Other by-catch species include dorado and sierra. All the by-catch is marketed domestically. Bahia Cupica representatives note that their firm is one of the few Colombian companies affiliated with large foreign longliners.[284]

CIMAR: This company has processing plants in Buenaventura, Cali, and Tumaco. It has the capacity to produce 9.6 t of tuna loins daily (appendix A5c). No association contracts with foreign companies were reported in 1995, but agreements were signed with 11 Ecuadorean vessels in 1996 (appendices A5c and A6d), presumably all small purse seiners. CIMAR primarily ships to European countries.

COAPESCA: This Cartagena-based processing company focuses primarily on shrimp and obtains raw material from associated foreign shrimp trawlers and local shrimp farmers. The company also handles some finfish, lobster, conch, and crab. Much of this product is supplied by an associated foreign lobster boat which deploys divers. Company officials indicate that they have never had formal association contracts with foreign longliners. The company did, however conduct experimental swordfish operations in 1995. While some swordfish were taken, the company decided not to pursue commercial operations because of high mercury content encountered in the fish taken.[285] The company was not one of the companies INPA reported as working with foreign tuna vessels in either 1995 or 1996 (appendix A5c and

A6d).[286]

COPESCOL: Compañía Pesquera Colombiana (COPESCOL) has facilities in Buenaventura and Cali. The company was one of the first to re-enter the tuna industry in the late 1980s.[287] Colombian tuna canneries closed in the 1970s and significant canning operations were not resumed until the late 1980s. (See "Government Agencies and Policies: Promotion".) COPESCOL produced vacuum-packed tuna loins and canned products. Output during 1994 totaled about 5,000 t of tuna (appendix C1). COPESCOL was the most important operator of foreign tuna vessels and in 1995 planned to work with 22 vessels, mostly purse seiners. The company, however, reported that it encountered a variety of problems, including: the U.S. tuna embargo, management difficulties, El Niño conditions, and other adverse circumstances. As most of these problems were also faced by other Colombian companies, presumably management difficulties was the major factor forcing the company to close during 1995.[288]

COPESNAR: Corporación Pesquera de Nariño (COPESNAR) is a private, non-profit corporation responsible for the administration of the Tumaco fishing port. COPESNAR offers services (water, ice, fuel, food, and assistance obtaining Government permits). COPESNAR also provides refrigerated storage and areas for processing the catch, especially tunas and other large pelagics. Company officials report that in mid-1997 that they were working with two small seiners (120 tons). COPESNAR, for example, has also reportedly worked with two Chinese longliners (*Hua Yuan Yu 9* and *10*) during 1996 (appendix A6d). Profits earned by COPESNAR are invested in the maintenance and expansion of the port, the Escuela Técnica de Pesca, and the local Rotary Fund. were operating from Tumaco. The company has reserved space at Tumaco for a tuna cannery and loining facility with a capacity of about 40 t daily.[289] The company is planning a longline project and has contracted a Canadian longliner (*Flaying Dart*) to do test fishing. They are currently discussing arrangements with New Zealand and United States longline operators concerning possible future association agreements.[290]

FRIGOGAN: Frigorífico Ganadero (FRIGOGAN) is one of the larger Colombian companies. It is was established in 1991 and is located in Baranquilla. The company produces eviscerated and loined frozen tuna and canned tuna. The company handles skipjack, yellowfin, bigeye, and other species and in 1994 produced about 32 t of loins and 16 t of canned product daily (appendix C1). FRIGOGAN in 1997 reports a capacity of producing 70 t of tuna daily. They also produce fishmeal. The company does not own its own vessels, but worked with 15 foreign tuna vessels in 1995, all purse seiners, and 14 foreign vessels in 1996 (appendices A5c and A6d). The foreign vessels during 1995 were flagged in Belize, Ecuador, Panama, the United States, Vanuatu, and Venezuela. Company officials describe efforts to process "dolphin-safe" tuna, but have experienced problems obtaining sufficient raw material from the associated vessels. The company exports about 80 percent of its production, primarily to Europe (Italy and Spain) and the United States (California and Puerto Rico). Most of the exported product is loins while the canned product is marketed domestically.[291]

FRIGOMARINA: This company licensed Russian and Panamanian tuna vessels in 1995, but only Panamanian vessels in 1996 (appendix A5c and A6d). No further details are available.[292]

FRIGOPESCA: Frigorífico y Pesca de Cartagena (FRIGOPESCA) is associated with one of Colombia's largest financial groups, the Grupo Bavaria. The

Photo 23.--Frigopesca's new tuna processing plant in Cartagena. Jaime Borda

company is located in Cartagena and primarily produces pre-cooked frozen tuna loins (photo 23). The loins are vacuum-packed in Cryovac plastic bags. The company handles primarily three species, yellowfin, skipjack, and bigeye, as well as some blackfin. The size of the loins vary with the species. The principal markets are canneries in the European Union (Spain and Italy) and the United States (Puerto Rico).[293] The company also handles a variety of other species, including swordfish and shark fins.[294] The facilities include a pier which can accommodate vessels up to nearly 8-m draft. The company has the capacity to process 40-50 t of tuna daily and a cold store which can hold 2,200 tons. FRIGOPESCA is developing a detailed Hazard Analysis Critical Control Point (HACCP) quality control system.[295] The company is a major operator of foreign tuna vessels, working with 18 vessels in 1995 from 8 countries (Ecuador, Japan, Korea, Panama, St. Vincent, Spain, Vanuatu, and Venezuela) (appendix A5c). The number of association contracts dropped to eight in 1996 (appendix A6d). Most of the vessels involved are purse seiners, but the company works with one longliner through Pescaderia Asturiana (appendix A7).[296] FRIGOPESCA, INDUPESCA, and Vikingos de Colombia all belong to the Vikingos Group. The company in 1996 was fully integrated into Vikingos and ceased operating as a separate company.

INDUPESCA: This company associated with the Vikingos Group was reportedly exporting tuna during 1995. It was not one of the companies working with foreign vessels.

INPESCA: INPESCA was established in 1962 and is involved in seafood processing and exporting. It does not own its own vessels, but instead purchases raw material from associated domestic vessels. The company is the largest shrimp processor in Buenaventura. Shrimp is the principal species processed, totaling about 80 percent of its output. INPESCA also has a tuna loining line. In addition, the company produces small quantities of fresh product from a variety of other species (tunas, sharks, billfish, jacks, and crabs). INPESCA works with 14 artisanal longliners operating out of Buenaventura. The fishermen reportedly deploy lines of about 4.5-9.0 km with 500-1,000 hooks. The shrimp is exported frozen to the United States, although the company is attempting to develop new markets in Argentina and Japan. The finfish (with the exception of the tuna loins) is sold frozen in the domestic market.[297] INPA reports that the company worked with a small number of foreign tuna vessels in 1995, all believed to be longliners. The four vessels were Japanese (*Chiyoda Maru 11, Chiyoda Maru 33,* and *Sasano Maru 17*) and one flag-of-convenience Panamanian flag vessel (*Sun 701*) (appendix A5c). INPESCA officials, however, report that this is an error and that the only longliners that they work with are small domestic vessels.[298]

MARCOL: This Tumaco-based company was established in 1964. Its primary activity is currently tuna canning. The company has no vessels but purchases tuna from small purse seiners and other companies. Smaller quantities are obtained from artisanal fishermen fishing with hook and line and driftnets. Company officials report that tuna often come into coastal waters during May and August which is when most of the product obtained from the artisanal fishermen is purchased. The artisanal fishermen also land small sharks. Incidental billfish and swordfish catches are minimal. One unconfirmed report indicated that this Tumaco company was working with a foreign longliner, but company officials indicate that the report that this erroneous.[299] INPA reports that the company worked with two foreign tuna vessels in 1995 (Ecuadorean and Panamanian), but the vessel were seiners (appendix A5b).

Marisol de Pacífico: This Buenaventura company reportedly worked with a U.S. tuna purse seiner in 1995, but not 1996 (appendices A5c and A6d).

Océanos: This Cartagena-based company was established in 1983. It is involved in fishing, aquaculture, processing, and exporting operations. The company primarily works with shrimp, but is planning to initiate tuna longline operations. The company processes and markets the shrimp harvested at its two farms. The company also operates three 22-m vessels (the *Rosalin*, *Lorimar* and *Don José*). The *Rosalin*, which is the only vessel actually owned by the company, is deployed in the lobster and queen conch fishery. The *Don José*, is a Venezuelan flagged shrimp trawler affiliated with the company. Company officials are planning to convert the *Lorimar*, which is currently inactive due to mechanical problems, from a shrimp trawler to a surface longliner targeting tuna. The company's major shrimp export markets are Spain and France and trial exports have been made to Japan. The company exports the lobster primarily to the United States. Océanos was affiliated with two Japanese longliners during the late 1980s, (the *Yushu Maru 51*, and the *Victoria 1*) for approximately 4 years. According to company officials, the vessels operated in the Caribbean, Central Atlantic Ocean, and the Pacific Ocean. The average trip was 80-90 days long and the average catch was composed of about 120-150 t of tuna (mostly yellowfin and bigeye) and

composed of sharks (appendix B4). Also, small quantities of marlin, dorado, king mackerel and opah were taken. Swordfish catches were minimal.[300]

Pescaderia Asturiana: This Cartagena-based company was established in 1985. It is involved in processing and exporting operations. The company has been affiliated with two foreign longliners, a Panamanian-flag longliner *Victoria 8* (owned by Japanese company) and serves as a representative company for a Japanese-flag longliner, the *Yushu Maru 51* (which is officially affiliated with Frigopesca) (appendices A5c and A6d). The crews are made up of Colombian, Japanese, and Indonesian fishermen. The vessels are about 180 GRT and they take trips of between 60-90 days. The vessels are deployed in both the Caribbean and Atlantic Ocean as far east as the Mid-Atlantic Ridge (40-50°W). Pescaderia Asturiana has been affiliated with these vessels since 1991. The company provides the fuel, water, provisions, repairs, operating costs, and crew salaries. These costs are then subtracted from the amount paid for the fish when the catch is landed. Catches vary from 40-50 t on short trips to 130-150 t on the longer 2-3 month trips out into the Atlantic. Landings are primarily tunas (yellowfin, bigeye, and albacore) which can total up to 80-85 percent of the fish retained. The by-catch commonly is composed of sharks (10-16 percent), marlin (2 percent), and sailfish (1-2 percent), sierra (up to 1 percent), and a variety of other species (1 percent) (appendix B4). The sharks retained are mostly makos and blues. Swordfish are also occasionally taken, but the proportion is very small. Some sierra and dorado is also reported in the by-catch. The catch of the *Victoria 8* is landed at Cartagena and the tuna loaded directly on to waiting Japanese freezer vessels. This is necessary to

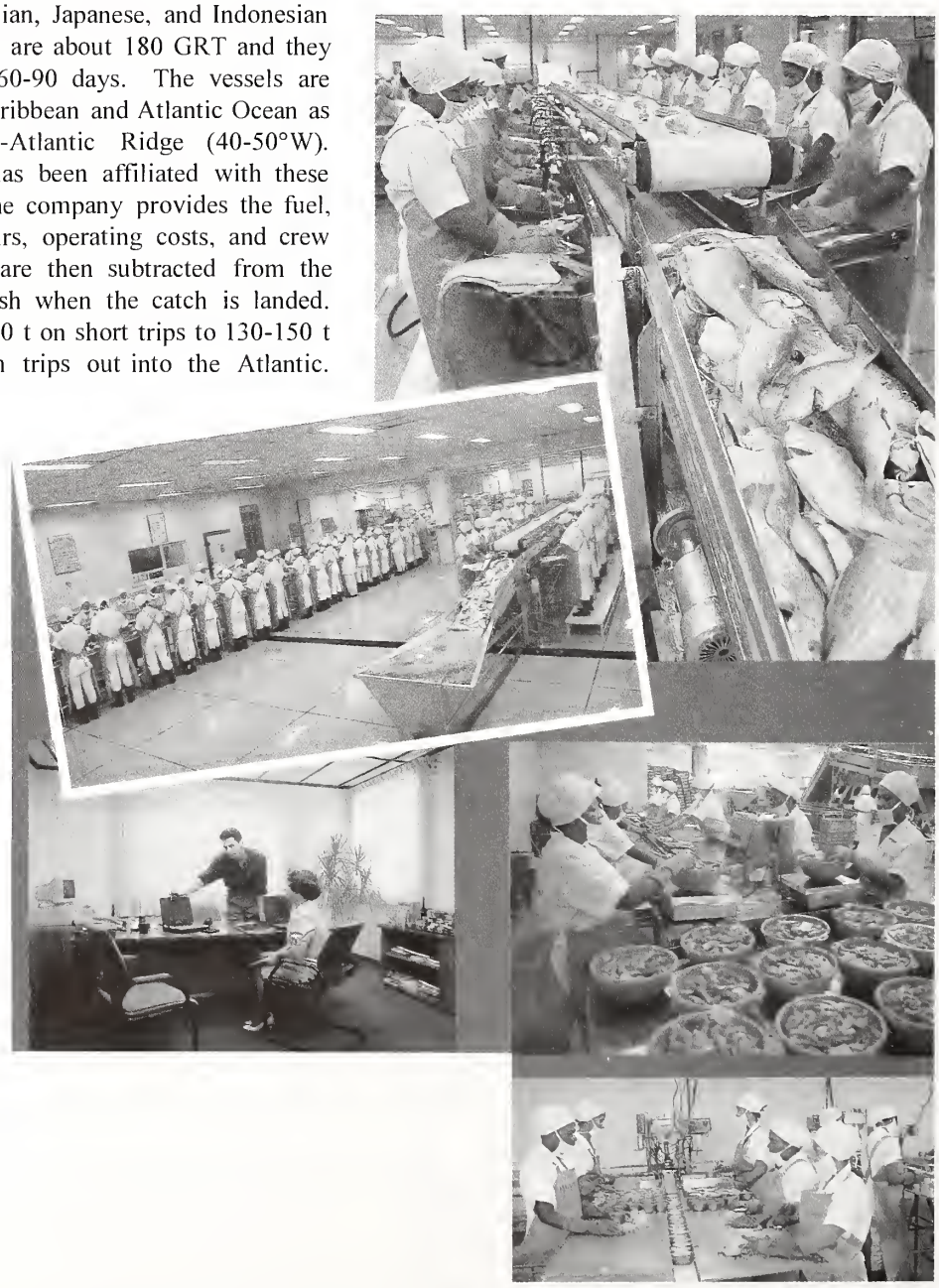

***Photo 24**.--Colombian companies like Vikingos have some of the most modern seafood processing plants in Latin America. Alfonso Morales*

preserve the quality of the tuna which is kept at -50°C. Such low temperature cold stores are not available at Colombian ports. The tuna is in effect purchased by Pescaderia Asturiana at international prices. The resulting shipments are considered a Colombian export, but the affiliated Japanese company, given its familiarity and contacts in the Japanese market, actually handles the details associated with marketing the tuna in Japan. The *Yushu Maru*'s tuna catch is handled in the same way, but the exporting company is the official Colombian partner (formerly Frigopesca/now Vikingos).[301] Pescaderia Asturiana is the representative of the Japanese company in Colombia, and although it is not the official affiliated company, it does market the vessel's by-catch. The by-catch of both vessels is marketed domestically frozen (whole, fillets, and steaks) to restaurants, hotels, supermarkets, and central markets. The company also buys other seafood from artisanal fishermen and markets the product domestically (frozen) in two major forms: 1-lb boxes or trays ("plegadizas"). The major domestic markets besides Bogota are coastal cities where the population is accustomed to seafood (including Cali, Cartagena, and Barranquilla).[302] Pescaderia Asturiana has attempted to market fresh tuna in the United States, arranging for a Japanese longliner to deliver fresh fish. The company, however, reported difficulties coordinating the vessel landings with available air cargo space. Delays adversely affected the quality of the product delivered. Company officials believe that there is great potential in fresh fish and is attempting to find another partner for future such operations.[303]

PROPESCOL: This Buenaventura company was reportedly exporting tuna in 1995. It was not one of the companies working with foreign vessels, but worked with two Colombian purse seiners in 1995 (appendix A5c).

Seatech: This Cartagena company was reportedly exporting tuna in 1995. It is affiliated with Atunes de Colombia which worked in association with several foreign vessels. Seatech handles the export of the processed tuna. Company representatives have declined to provide the authors with information regarding the company's operations.[304]

Supertuna: This Caribbean-coast company operated Ecuadorean and Venezuelan seiners out of both Barranquilla and Cartagena for the first time in 1996 (appendix A6d).

Vikingos: Cartagena-based Comercializadora Internacional Pesquera Vikingos de Colombia is one of Colombia's oldest fishing companies (photo 24). It is the largest Caribbean shrimp trawl processor. While the company has traditionally focused on the shrimp fishery, it has recently diversified into high-quality finfish. One 1995 report indicated that the company was also beginning to can tuna for the domestic market and produce loins for export, primarily to Spain and Italy. The tuna operations are reportedly growing rapidly and the processing capacity is currently 60 t daily. The company had association contracts with three purse seiners (from Vanuatu and Venezuela) in 1995 (appendix A5c), but expanded these operations to six seiners (from Ecuador, Mexico, and Venezuela) in 1996 (appendix A6d). The company does not, however, work in association with foreign longliners and does not handle fresh tuna or swordfish. Vikingos de Colombia, FRIGOPESCA/Vikingos, and Indupesca all belong to the Vikingos Group.[305]

Other companies: Several other companies worked with smaller numbers of foreign tuna vessels (appendices A5c and A6d).

XII. Markets

A. Domestic

Fisheries consumption in Colombia has traditionally been extremely low and confined primarily to coastal population centers. The habit of eating seafood is not well-established in interior cities and the relatively high prices of fishing products, as well as the popularity of red meat, restrict domestic seafood sales.[306] Until recently, much of the fish available in inland cities was the freshwater species harvested by inland fishermen. Handling procedures were extremely primitive and, as a result, the quality of the available product was poor. Marine fish was available in the large Bogota urban area, but availability was extremely limited and quality questionable in most other inland cities.[307]

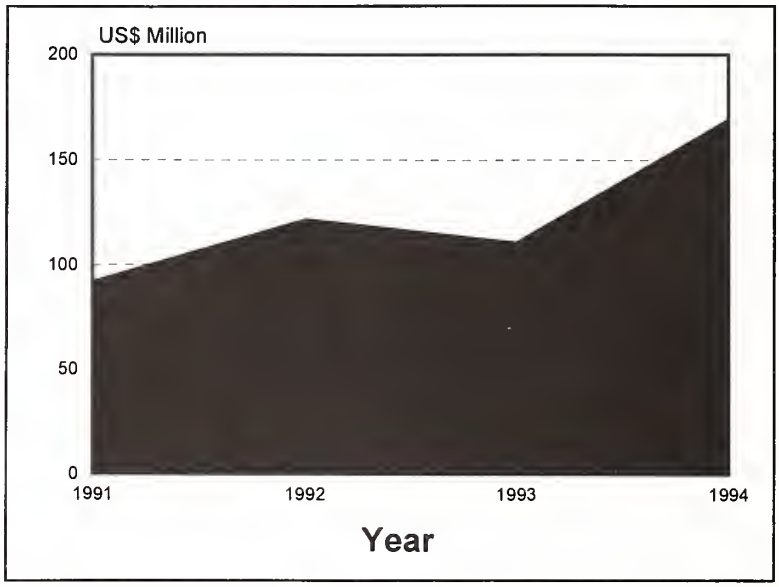

Figure 26.--Colombian fishery exports have nearly doubled since 1991 to $170 million in 1994.

Colombian companies during the 1990s have been significantly increasing the quantity of seafood channeled into the domestic market. The growing Colombian economy and expanding middle class is helping to increase the demand for high-quality seafood. Middle class consumers, especially housewives and employed women, appreciate the convenience of frozen fish. Increases are reported in the quantities of canned tuna and fresh and frozen shrimp and whitefish marketed domestically. Most of the tuna marketed in Colombia is canned (about 60 percent) while the remainder is fresh (20 percent) or frozen (20 percent).[308] There is an especially strong domestic demand for canned tuna. Colombia marketed 53 million cans of tuna domestically in 1994, equivalent to about 22,500 t of fish.[309] Domestic production of canned tuna has largely replaced imported product and Colombia now exports substantial quantities of its canned tuna.[310] Canned tuna exports increased from $4 million in 1991 to nearly $49 million in 1994.[311]

Swordfish, because it is rarely caught by domestic fishermen, is only occasionally available in Colombian markets.[312] There does, however, appear to be a strong domestic market for the shark taken along the Pacific coast, most of which is sold fresh in central markets of the larger cities--especially Bogota, Medellin, Cali, and Pereira. The small billfish by-catch is marketed in the same channels.[313] Colombians prefer white meat fish, thus shark is popular and marlin is the preferred

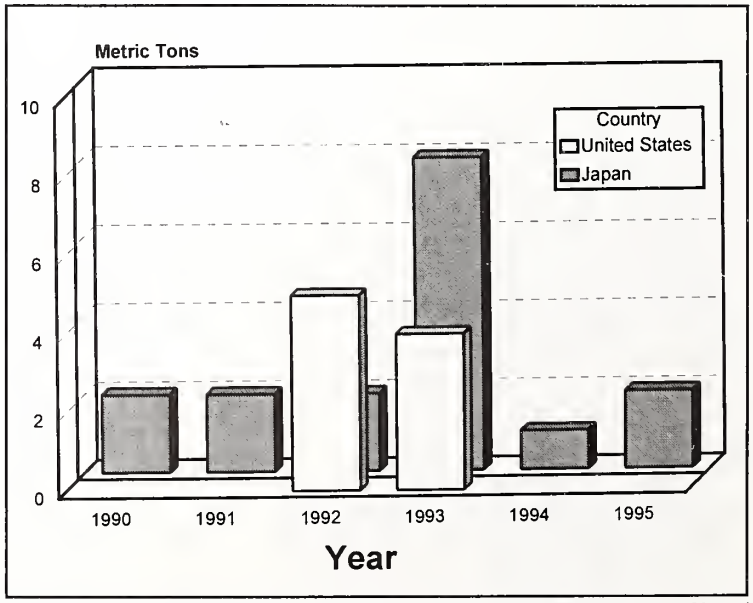

Figure 27.--Colombia has reported only rare swordfish shipments to the United States, but regularly ships small quantities of billfish to Japan.

billfish. Red meat fish such as sailfish and pink meat fish such as swordfish do not command as high a price as the marlin.[314] The sailfish and marlin is marketed as fillets and steaks, primarily in central markets.[315] (see "Processing and Products".) The small quantity of shark taken along the Caribbean coast is also sold fresh in various local markets or to Vikingos, but some of the shark fins are shipped to Venezuela.[316]

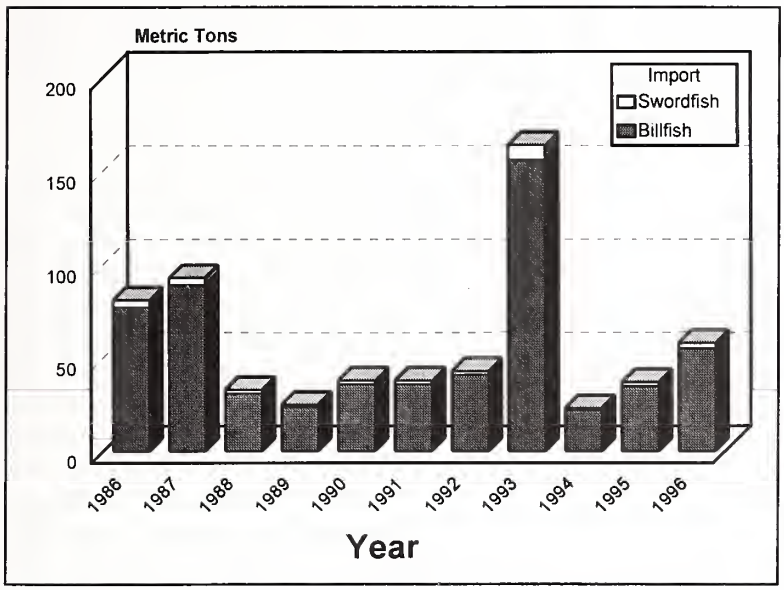

Figure 28.--The authors believe that there is little swordfish in the billfish/swordfish import basket category reported by Japan.

B. Trade

1. Exports

Colombia has significantly increased export shipments of seafood during the 1990s. Seafood exports approached a record $170 million in 1994, nearly double the $90 million exported in 1991 (appendix E1 and figure 26). Private companies have been assisted by Government-sponsored efforts to develop a commercial fishing industry and two of the sectors assisted (tuna and shrimp culture) have been responsible for much of the export increase (appendix E1). The principal commodities involved are fresh and frozen fish, frozen shrimp, and canned tuna. The principal export markets are the European Union and the United States.[317]

Colombia exports some billfish, but very little swordfish. Almost all of Colombia's tuna exports are taken by purse seiners. The country has not yet developed a domestic commercial longline fleet. Very small swordfish and billfish shipments are reported to the United States and Japan. Colombian shipments to the United States are normally minimal (appendix E2a and figure 27). The last small shipment to the United States was reported in 1993. Colombia does export billfish and swordfish to Japan. Available trade data, however, is confusing because the Japanese groups swordfish and billfish together in a single basket category.[318] The authors believe that swordfish is a small part of the billfish shipments, probably no more than 1-2 t in most years.

European Union: Colombia has not exported swordfish to the European Union.

Japan: Virtually all of Colombia's billfish (mostly sailfish and marlin) exports are shipped to Japan. Shipments are limited and have fluctuated substantially in recent years. Billfish shipments of about 90 t in 1987 declined to only 24 t in 1989. Shipments have since ranged from 22-36 t, with the exception of 1993 when 156 t of billfish were shipped to Japan (appendix E4a1 and figure 28). Colombian officials report that the Japanese longliners operating in association with Colombian companies do not catch significant quantities of billfish and are unsure as to

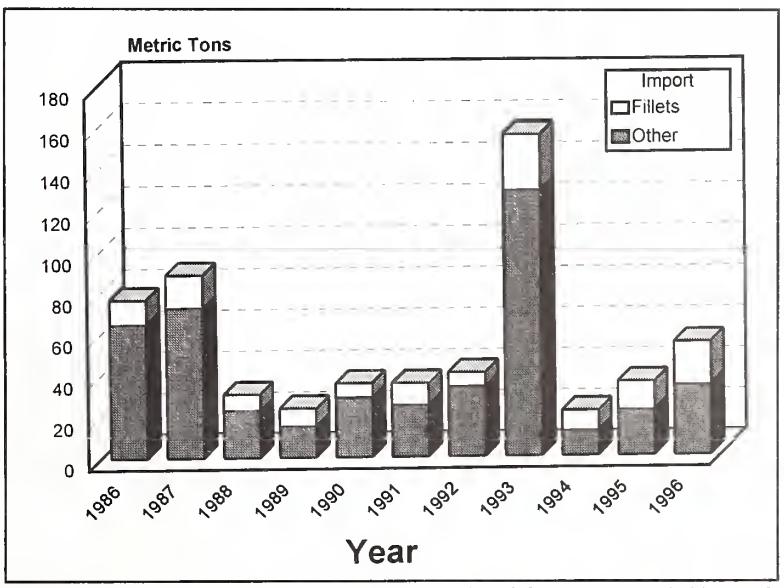

Figure 29.--Colombia shipped record quantities of billfish to Japan in 1993, mostly frozen trunks.

the source of the imports noted by Japan.[319] Most of the billfish was shipped as frozen trunks, although the Japanese report some fillets were also shipped (appendix E4a2 and figure 29). Colombian sources, however, insist that the foreign longline catch is not being processed in Colombia. Given the low apparent abundance of swordfish off Colombia, swordfish probably constitutes a very small part of these shipments. Swordfish may have constituted no more than 8 t of the unusually large 1993 shipments, but normally probably amount to only about 1-2 t (appendix E2a).

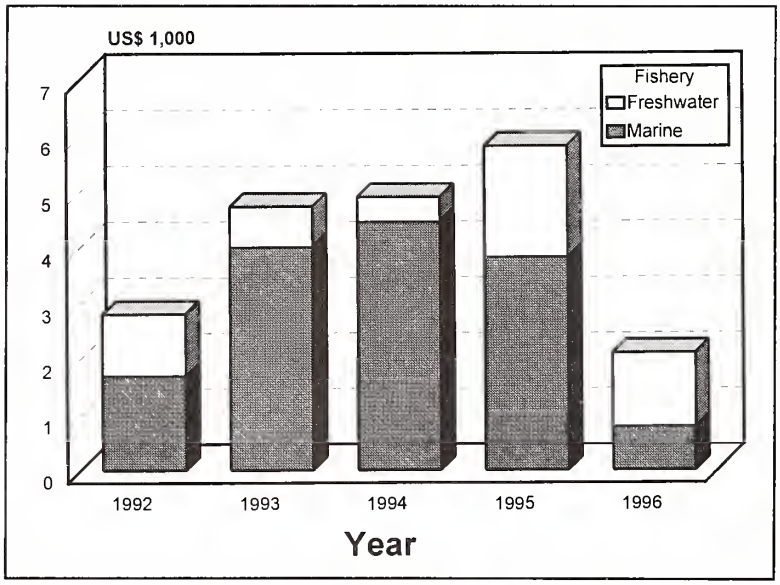

Figure 30.--Colombian fresh seafood exports to the United States increased to nearly $6 million in 1995. Substantial quantities in 1996 were cultured tilapia.

United States: Colombia does not normally export swordfish to the United States. The only shipments noted in recent years were 4-5 t reported in 1992 and 1993 (appendix E3a and figure 27). The limited shipments to the United States is further confirmation that virtually no swordfish is being harvested by Colombian fishermen. Given the attractive prices available on the U.S. market, the species would presumably be exported, if available. Colombia does, however, export some tuna to the United States. The commodity forms have primarily been frozen loins and lesser quantities of canned product. Shipments totaled $7.1 million (frozen and canned) in 1994, increased to $15.4 million (frozen) in 1995, but declined to only $6.1 million (frozen) in 1996 (appendix E3d and figure 30). Colombia since 1993 has been exporting about $4-5 million of fresh seafood to the United States, primarily groupers and various marine species. In 1995, shipments of cultured tilapia also were important. Shipments of fresh marine products declined sharply in 1996, but substantial quantities of tilapia continued to be shipped (appendices E3d-e and figure 30). Colombia exports, however, very small quantities of fresh tuna, only 5-23 t during 1990-92. No fresh tuna has been shipped since 1992. These shipments may have been affected by the United States intermediate tuna embargo which was in effect during part of 1992 (appendix E3g). The U.S. embargo was implemented as a result of a U.S. law designed to reduce the incidental mortalities of dolphins. ETP purse-seine fishermen often set on dolphins because of their association with yellowfin tuna. This practice has been largely discontinued by U.S. fishermen, but many Latin American fishermen continue to fish on dolphin. INPA has initiated a program to reduce the incidental mortality and participates in the IATTC dolphin conservation program which sets total and individual vessel mortality limits. The United States, however, prohibits the importation of tuna caught by encircling dolphins.[320] As a result, the United States imposed a primary tuna embargo on September 28, 1994 (appendix E3g). Longline caught fish, however, is unaffected by the primary embargo. Even so, the very

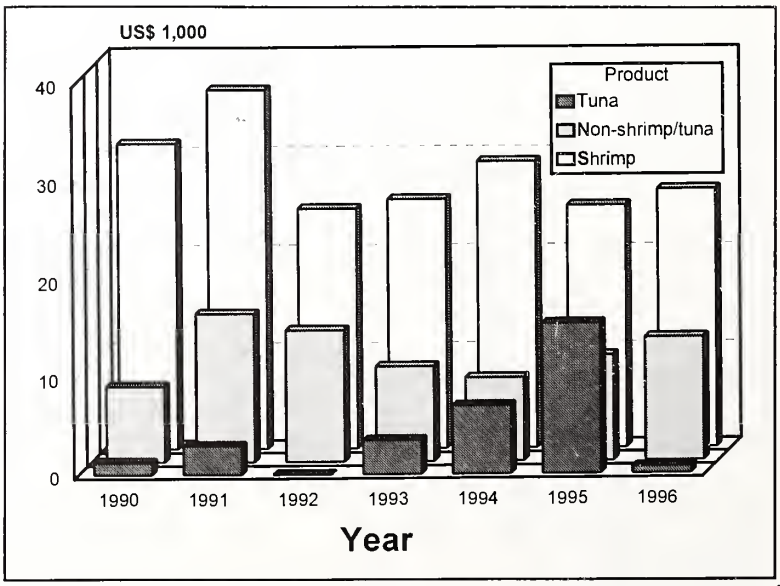

Figure 31.--Colombian companies are making little progress in increasing exports of high-quality tuna and other oceanic pelagics.

limited trade in fresh tuna interrupted in 1992 has never resumed. It is unclear why the Colombians have not resumed fresh imports. The substantial yellowfin catch of the purse seiners demonstrates that a sizeable tuna resource is available. Not only are fresh tuna shipments to the United States minimal, other imports normally associated with a longline fishery (such as shark meat) are also negligible (appendix E3c and figure 31).[321]

2. Imports

Colombia imports some fishery products. Shipments have increased from nearly $35 million in 1991 to over $50 million in 1994, slightly more than the inflation rate. The bulk of Colombia's imports are fishmeal imported from other Latin American countries. Colombia also imports some edible product, fresh fish and frozen fillets totaling $10 million in 1994.[322] The authors know of no swordfish imports. The Andean Pact appears to have had a favorable impact in increasing inter-regional trade.

XIII. Government Agencies and Policies

A. Agency

The Colombian agency responsible for fisheries is the Instituto Nacional de Pesca y Acuicultura (INPA) of the Ministerio de Agricultura y Desarrollo Rural. INPA replaced the former Colombian natural resource agency, the Instituto Nacional de Recursos Naturales Renovables y del Ambiente (INDERENA) which for many years had been responsible for fisheries. INPA is assisted by an advisory council, the Consejo Nacional de Pesca y Acuicultura (CONALPES).

B. Law

Fishing is regulated in general terms by "Estatuto General de Pesca" (Law 13 of 1990) and necessary implementing regulations "Decreto Reglamentario" (Decree 2256 of 1991). The law promotes the rational management and exploitation of fishery resources. It also created INPA.[323] Law 13 and subsequent regulations authorize INPA to license foreign-flag fishing vessels harvesting tuna and other marine species. The foreign fishermen, with a few exceptions, have to first negotiate affiliation contracts with Colombian fishing companies.

INPA has set aside swordfish and billfish for recreational and artisanal fisheries. INPA's Board of Directors in a June 23, 1995, meeting, approved an agreement reserving swordfish, marlin, sailfish and other similar species for sport and artisanal fisherman.[324] The agreement was published in the *Official Gazette* on July, 19, 1995, thus prohibiting directed commercial fishing for these species. The use of trawls and purse seines for these species is specifically prohibited, although this is not how these species are caught. Only single hand-line or pole-and-line fishing, with or without artificial or natural bait, is allowed. Under Colombian law, this agreement has the force of law.[325] It did not, however, prevent commercial fishing in 1995 (appendix B3c2). Billfish by-catches are unregulated.[326] Artisanal shark fishermen also report billfish by-catches. In addition, several companies involved with associated foreign vessels also report billfish by-catches. There are no limits placed on these incidental catches as long as billfish are not directly targeted. Thus, as billfish are largely a by-catch of the shark fishery, the Colombian regulations have had little impact on the quantities taken. Commercial landings have continued.

C. Limits

Colombia declared a 12-mile Territorial Sea and a 200-mile Exclusive Economic Zone (EEZ) in 1978.[327] The country subsequently signed the Law of the Sea Convention in 1982.

Colombia's two coasts and island territories in the western Caribbean have necessitated extensive marine boundary negotiations with several neighboring South and Central American as well as Caribbean countries. Marine boundary agreements have been signed with Costa Rica (1977 and 1984), Dominican Republic (1979), Ecuador (1975), Jamaica (1994), Haiti (1979), Honduras (1986), and Panama (1977). Outstanding

boundary disputes with Venezuela and Nicaragua have prevented agreement on boundary delimitations along the eastern Caribbean coast and around the offshore islands in the western Caribbean. The boundary disputes with these two countries are unlikely to be resolved in the near future.

D. Licenses

The Estatuto General de Pesca and the implementing regulations authorize foreign-flag fishing vessels to fish tuna, and other species, if they have affiliation contracts with Colombian fishing companies approved by INPA.[328] The associated company has to obtain an annual fishing license from INPA and a permit to operate within Colombian waters from the Dirección General Marítima (DIMAR).[329] The associated vessels are required to operate with at least 5 percent Colombian personnel. The law provides the legal basis for the largest licensing program in Latin America. Nearly 170 foreign vessels were licensed to work in association with Colombian companies in 1995 (appendix A3b).

The Colombians also issue special licenses for exploratory commercial fishing. The fishermen receiving these licenses have to submit data to INPA. The licenses are valid for 1 year and can be extended for another year. As part of the licensing requirements, these vessels must carry Colombian observers to confirm the accuracy of the data collected.[330]

E. Promotion

Colombia for years gave little attention to the fishing industry. The Government's primary focus was on agriculture, although in recent years a variety of efforts to promote the industrial diversification of the economy have achieved some success. Colombia's small fishing industry criticized the Government for this lack of attention. Fishing industry representatives were especially critical of the terms for Colombia's entry into the Andean Pact, which they claim caused the failure of about 13 domestic fish canneries during the 1970s. Other fishing companies were also adversely affected. The Government intervened and purchased shares in important shrimp exporting companies, but not the tuna canners.[331] Fishing industry groups in the 1980s continued to criticize the Government for its lack of attention to fisheries.[332]

More recent Colombian administrations have begun to devote increased attention to developing the country's fishery resources. Colombia sought FAO assistance in the early 1980s on how to assess and develop available resources. FAO technicians conducted an extensive survey of the existing industry, available resources, and development potential.[333] The resulting PROPESCA program was the Government's first important initiative to develop a modern fishing industry.

Artisanal fisheries: One of the important elements of the program was assistance to artisanal fisheries.[334] The Government established a new agency specifically to assist artisanal fishermen, the Centro de Servicio a la Pesca Artesanal (CESPA).[335] Results are difficult to assess. Various Government agencies have attempted to assist the large artisanal fishing sector.[336] Several development programs were initiated in the 1980s.[337] A variety of agencies besides INDERENA/INPA have been involved, including regional development corporations.[338] Although results are hard to measure, the artisanal fishery has expanded in recent years. INPA which initiated several projects to assist artisanal fishermen was reportedly formulating a new technical assistance program in 1993 for artisanal fishermen.[339]

Shrimp culture: The Government has played an important role in developing Colombia's shrimp culture industry.[340]

Tuna processing: Supportive Government policies during the 1990s have helped to build a modern tuna processing industry. (See "Fishing Industry Overview".)

INPA currently continues to devote significant attention to the artisanal fishery. The agency administers the Proyecto de Pesca Artesanal Marítima to assist the artisanal fishermen modernize their marine operations.[341] A variety of other INPA projects have focused on stock assessment, fisheries management, different capture fisheries (tuna, whitefish, shrimp, clams, and others), and aquaculture.[342]

XIV. Research

Very little fisheries research is under way in Colombia. The Colombian research capability is limited and poorly funded by the Government. Much of the research conducted is highly academic biological work, focusing primarily on the species traditionally harvested such as shrimp, lobster, grouper, and other familiar. Other authors have focused on newly encountered species of no commercial interest. The authors know of very little Colombian research on highly migratory tunas and no work on billfish, or swordfish.[343] The most important Colombian fisheries research is conducted by INPA, but there are also a few academic institutes which work on fisheries and other marine disciplines. INPA and the other Colombian marine research institutes have not conducted any research related to commercial swordfish fisheries.

INPA: The INPA research program has focused on the species most heavily targeted by Colombian fishermen. They have also done considerable work on artisanal fisheries.[344] INPA has conducted little research on oceanic pelagics.[345] Some INPA projects, however, have involved sharks and related fishing methods. INPA's Marine Artisanal Project conducted some research during 1992 which included work with longlines. One project in Magdalena Department included assessments of a variety of gear, including an artisanal longline. The principal species taken were sharks.[346] INPA has conducted an assessment during 1994 of the tuna landed in the Buenaventura canneries with emphasis on size and quantities. INPA also keeps records on artisanal and commercial shark landings, emphasizing Carcharhinidae and Sphyrnidae (hammerheads). The data includes species and reproductive sates. Billfish are by-catch species, but there is little research or data collected on these species.[347]

INVEMAR: The Instituto de Investigaciones Marinas y Costeras (INVEMAR) is Chile's principal university research institute specializing in marine studies. It is a non-profit corporation supported, but autonomous from the Ministerio de Medio Ambiente.[348] INVEMAR primary focus is basic and applied environmental research on renewable natural resources and costal and oceanic ecosystems. INVEMAR prepares technical assessments for the Ministry and other Colombian national and local agencies. INVEMAR's main focus is currently on: 1) biodiversity/ecosystems, 2)utilization (mariculture and capture fisheries), 3) environmental quality, and 4) information systems. INVEMAR has done a great deal of work on fisheries, but has focused primarily on artisanal inshore fisheries, shrimp, and aquaculture. The Institute has done little work on oceanic pelagics and no work on swordfish.[349]

Other: Various Colombian universities operate some fishery research stations, but they primarily work on freshwater species. A considerable number of reports focus on newly discovered species. Individual companies have conducted test fishing and collected data from associated foreign vessels. Little of this information, however, is available to the authors. One company (Coapesca) reports test fishing for swordfish in the Caribbean during 1995, but found fish with high mercury content.[350]

Some work has been reported by foreign researchers:

Cuba: Cuban and Soviet researchers working with longlines in 1964 reported good concentrations of tuna off Colombia (10°N, 77°W) during July that moved to east off Venezuela's Paraguaná Peninsula from August to October.[351] No information is available on possible swordfish by-catches.

IATTC: The IATTC which initially focused its research on tunas has in recent years given increasing attention to swordfish and billfish in the southeastern Pacific. IATTC is currently planning some genetic work on swordfish.

ICCAT: ICCAT coordinates an active research program on Atlantic swordfish. The research is done by researchers in member countries with ICCAT serving to coordinate the work. The authors know of no ICCAT activities on swordfish in Colombia, but neighboring Venezuela and several Caribbean island countries are active.[352]

Japan: Japanese fishing data compiled by the longline fishermen represent an extremely valuable source of information.[353] This is the most extensive collection of longline data in existence, both in the Pacific and Atlantic. The data has been compiled and analyzed by the National Research Institute of Far Seas Fisheries (NRIFSF).[354] The authors know of no Japanese studies specifically on swordfish off Colombia. The Japanese have, however, been the primary country longlining off Colombia. As a result the NRIFSF has the most extensive data set on longline fisheries along the Colombian coast.

USSR: The Soviets worked with Cuban researchers in the Caribbean during the mid-1960s. (See "Cuba" above.) Colombia authorized the Soviet trawler *Leninskaya Kuznitza* to conduct exploratory research in early 1978. The Soviets reported concentrations of horse mackerel ("caballa," *Schomber sp.*).[355]

United States: NMFS researchers at the Southeast Fisheries Science Center (F/SEC) in Miami and the Southwest Fisheries Center (F/SWC) in La Jolla have been active in the Caribbean/Atlantic and Pacific in a variety of work involving swordfish. Little of this work, however, has involved the waters off Colombia. Much of the F/SEC's efforts in the Caribbean, has involved working with Venezuela and various eastern Caribbean island countries to collect data and analyze billfish and swordfish biological samples as part of the ICCAT research effort. U.S. cooperation with neighboring Venezuela has been particularly close on both swordfish and billfish.[356] There is, however, no cooperative effort with Colombia in the western Caribbean. NMFS has conducted extensive cruises collecting data on larval fish throughout the Caribbean, although recent effort has been directed primarily at bluefin in the Gulf of Mexico. As a result a comprehensive data base exists on the distribution of swordfish and billfish larvae. NMFS has also done some genetic work, both in-house at its Charleston Laboratory and through contractors. No Colombian swordfish, have yet been sampled. F/SWC activity in the Pacific has centered on the waters off California and Hawaii where the U.S. fishery is conducted. The F/SWC Laboratory in Honolulu has been particularly active with longline fisheries for tunas and billfish. Plankton surveys have provided some data on larval distribution. Tagging work has provided some limited returns. F/SWC has also sponsored some genetic work at Stanford.

Other: Foreign fishing data has been published by two other distant-water countries (Korea and Taiwan).[357] The data in these reports, however, is primarily on tuna operations. Data from those countries, along with data from other Pacific fishing countries, has recently been compiled by FAO in a comprehensive atlas of Pacific tunas and billfish which provides seasonal and geographic catch data.[358]

XV. By-catch

Very limited data is available on current and potential by-catches of longline and driftnet operations off Colombia. The authors know of no published works describing by-catches in longline and driftnet fisheries. This is presumably due to the limited domestic development of these fisheries. There is no Colombian commercial longline fishery targeting tunas and swordfish.[359] (See "Fleet".) The artisanal longline, as well as driftnet, fishermen operating in coastal waters do report by-catches. Foreign longline fishermen also report by-catches, but little information is available on such catches in Colombian waters.[360] Colombian and foreign observers are generally reluctant to discuss the by-catch. U.S. trade actions resulting from by-catches in the tuna (dolphin) and shrimp (turtles) fisheries have been widely publicized in the Colombian media. Foreign fishermen have also been affected by international concern over the by-catch associated with driftnets and other distant-water fisheries. Thus many company officials were reluctant to speak openly to the authors fearing that the information could be used against their company in the future.

Available information on by-catch includes:

A. Pacific

Colombian artisanal and semi-commercial longlines take a variety of species. These largely coastal fisheries primarily target shark and swordfish is minor by-catch species (appendix B4). While shark is currently a target species, it would be a by-catch of any future Colombian tuna and swordfish longline fishery. Little published information is available on foreign longline by-catches in the ETP.[361] Foreign tuna longline fishermen retain the swordfish and billfish as well as some of the shark by-catches, but no information is available on the by-catch discarded. Interviews of the Colombian companies associated with the Japanese longliners reveal that the target tuna species are a very high percentage of the catch. Available estimates suggest that about 85 percent of landings, different than actual catches, is the target species (appendix B4). While a relatively high proportion, it is lower than the actual catch data reported by the Japanese in the western Pacific: Western Tropical Pacific (94 percent) and Western Subtropical Pacific (85 percent).[362] Assessing the by-catch of the foreign longline fishermen associated with Colombian companies is complicated because

Photo 25.--Artisanal fishermen through the 1980s took small quantities of sharks from small boats. Dennis Weidner

fishing takes place off Colombia while some is on distant-water grounds. (See "Fishing Grounds".)

Shark: The small-scale longlining along the Pacific coast targets primarily sharks and dorado. Artisanal fishermen also take sharks with hand lines (photo 25). Thus shark, a major by-catch species in directed swordfish fisheries, is not a by-catch but a primary target species of the artisanal/semi-commercial longliners. The foreign longliners working with Colombian companies primarily target tuna, but most of the retained by-catch is sharks (appendix B4). Various reports suggest that about 15 percent of the retained by-catch is shark.[363] The species retained are primarily makos and blues.[364] Sharks are a much larger proportion of the actual catch composition, but much of the shark by-catch is finned and discarded to reserve limited hold space for the more valuable tuna.

Swordfish: There is a very small swordfish by-catch reported by the artisanal shark longliners.[365] The company currently working with Japanese longliners in the Pacific reports that the focus is on tuna and that swordfish are rarely taken (appendix B4).[366] Overall Japanese longline operations take substantial quantities of swordfish.[367]

Tuna: The Colombian domestic tuna catch is primarily taken by the purse-seine fleet. Artisanal fishermen and the semi-commercial longliners targeting shark report relatively limited tuna catches. The Japanese longliners operating out of Colombian ports, both within and beyond Colombian waters, primarily target tuna, which constitute the great bulk of landings (appendix B4). No data is available, however, on the proportion of the catch.

Billfish: The authors have had difficulty obtaining details on the Colombian billfish catches. There appears to be no directed fishery with the exception of the small recreational fishery. Thus the marlin and sailfish catches reported by INPA (appendix B3a2) appear to be the by-catch taken in other fisheries. Local observers, however, provide varying assessments. One observer reports that the billfish catch comes primarily from the artisanal longline fishermen conducting semi-commercial operations for shark and other species.[368] Another observer reports that driftnet fishermen may be taking some of the billfish.[369] Yet another report indicates there is no significant billfish (sailfish and marlin) by-catch.[370] INPA catch statistics report that most of the billfish by-catch is taken along the Pacific coast (appendix B3a2 and figure 22). Foreign fishermen report limited billfish catches because they employ fishing strategies designed to maximize tuna catches. One associated company confirms that the Japanese focus is on tuna and the billfish catch of sailfish and marlin is very limited (appendix B4).[371] Another Colombian source reports that Ecuadorean tuna longline fishermen reported a substantial marlin by-catch around Malpelo Island.[372] Based on these somewhat differing accounts, it is unclear to the authors as to what fishery is landing the billfish catches reported by INPA (appendix B3a2) or the product being shipped to Japan (E4a1). INPA's statistical reports have generally indicates that the principal species taken are sailfish and marlin. One 1996 INPA report provides data on the relative importance of Pacific marlin (appendix B3a3 and figure 32). Other observers, however, provide varying estimates of the catch composition. FAO reports indicate that the Japanese have generally taken larger quantities of stripped and blue marlin.[373]

Sea turtles: Several species of sea turtles (including black[374], green, hawksbill, leatherback, loggerhead, and olive Ridley) are present in Colombian waters. Turtles in the Pacific nest on Gorgona Island and the along the coast of Chocó.[375] Artisanal fishermen in the past targeted turtles and many fisheries, such as the shrimp trawl fishery, still take turtles incidentally.[376] Environmentalists reported unusually large mortalities along the northern Pacific coast in 1990.[377] Some observers speculated that artisanal driftnet fishermen may have been responsible.[378] This is unlikely because artisanal fishermen would almost certainly have retained the turtles. Other possible explanations such as the discards by shrimp trawl fishermen, viral infections, and other factors appear more likely.[379] INPA has initiated a Turtle Exluder Device program to reduce the turtle by-catch in the shrimp fishery. Virtually no information is available on the actual by-catch levels of the shrimp trawl and other Colombian fisheries.[380] One Colombian observer insists that the small-scale artisanal longline fishermen targeting shark in the Pacific report almost no turtle interactions because of the low salinity of the waters in which the lines are usually set.[381] Turtle specialists, however, report that marine turtles can (and do) tolerate a wide range of salinities. Most would not agree that proximity to river deltas has a negative influence on the occurrence of marine turtles. Some of the most productive foraging habitat for Kemp's ridley in the Gulf of Mexico, for example, is in very close proximity to the Mississippi River Delta. These areas are often nutrient-rich and likely support an important prey base for foraging turtles such as Ridleys and loggerheads. Green turtles are dependent on seagrass and algae, which, depending on the species, can also tolerate varying salinity regimes. Thus the potential for incidental capture based on proximity to river deltas cannot be ruled out. Additionally, migrating turtles and adults in the inter-nesting interval likely use these habitats as well, at least during certain time periods.[382] There is also no data available on turtle interactuins with foreign longliners. One study suggests that foreign longline fishermen in the western Pacific seldom or rarely take turtles and do not retain them.[383] Ecuadorean officials, however, report seizing turtle skins aboard Japanese longliners.[384] U.S. fishermen operating off

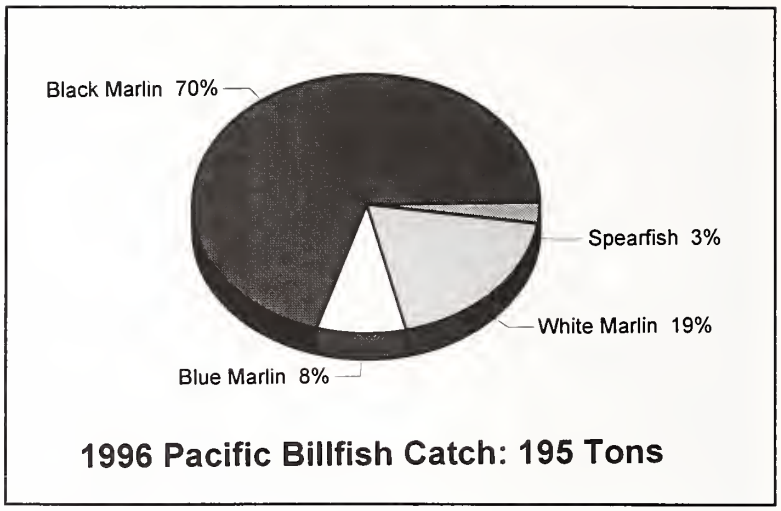

Figure 32.--The Colombian Government reports large catches of black marlin in the Pacific, but other sources report a different species composition.

Photo 26.--The tuna seine fishery reports a substantial by-catch. After removing the tunas, fishermen report species like sharks, sailfish, dorado, pampanos and others. Manuel Ramírez

Hawaii do report turtle interactions. Although there were relatively few mortalities, a large fleet could have a potential impact on a critically endangered species.[385] One such species of great concern is leatherbacks. Mexican officials report that leatherback nestings have reached critically low levels.[386] Anecdotal accounts and tag returns have noted incidental catches of leatherbacks from Mexican and Costa Rican beaches in the southeastern Pacific as far south as Chile. Recent satellite tagging data shows that after nesting at Mexican beaches, leatherbacks move due south through oceanic areas off Central America toward the Galápagos Islands and then continuing south (Peru, figure 30).[387] The limited current data suggests that the leatherbacks are not entering Colombian waters. The current Colombian fishery thus probably has limited interactions with leatherbacks, especially since the shrimp fishermen have begun using TEDs. Foreign longline activity in offshore waters, however, may be more significant.[388] The known track of the leatherbacks appears to be cutting through the center of the large Japanese tuna longline fishery in the ETP (Ecuador, figure 8) and toward intense Chilean, Peruvian, and Spanish fishing in the southeastern Pacific (Chile, figure 13).

Other: A variety of other fish, including an occasional opah, are also part of the longline by-catch.[389]

B. Caribbean

Colombian longline fishermen are less active in the Caribbean and billfish by-catches are generally less common than in the Pacific. Japanese longliners operating in association with Colombian companies operate in both the Caribbean and Atlantic Ocean (as far as 40-50°W).

Tuna: One Colombian company reports that the associated Japanese longliners retain mostly tuna, as much as 80-85 percent. Very little of the remaining by-catch is swordfish (appendix B4).[390] This represents the fish caught both inside and outside Colombian waters and is the catch retained, and thus is not a good indicator of the actual by-catch in Colombian waters. Japanese researchers report that overall Japanese tuna longline operations in the north Atlantic land a swordfish by-catch of 4-7 percent.[391]

Billfish: The billfish by-catch of the Colombian semi-commercial longliners appears to be very limited along the Caribbean coast (appendix B3a2). Associated Japanese longliners, however, report higher billfish landings in the Caribbean/Atlantic (appendix B4). One observer reports that Japanese billfish landings (sailfish and marlin) total about 4 percent in the Caribbean/Atlantic (appendix B4).[392]

Shark: INPA experimental artisanal longline fisheries report that the primary oceanic pelagics taken are sharks. While shark were the target of the test fishing they could be the by-catch in any future commercial fishery. The shark species taken in the test fishing during 1992 were hammerheads (*Spyma sp.*), nurse (*Ginglymostoma cirratum*), and "tintoreras" (*Carcharhinus sp.*) (appendix G). Catches were especially good during April and May. The nurse sharks had poor meat yields and their fins were not of commercial quality.[393] While these were the primary species reported in artisanal operations close to the coast, the species taken in offshore commercial operations for highly migratory tunas and swordfish could be quite different.

Turtles: Turtles are also found along the Caribbean coast. Nesting beaches are located east of Santa Marta, between the Piedras and Don Diego Rivers, and on some of the offshore islands and cays.[394] No information is available on interactions with longliners, but given the more limited extent of the shark fishery in the Caribbean, such interactions are probably less frequent than in the Pacific.

Other species: Associated Japanese longliners also take a variety of other fish, including king mackerel, and an occasional opah.[395]

XVI. International

A. International relations

1. Multilateral

Swordfish in the southeastern Pacific has received only limited attention from multilateral organizations. Several organizations involved with tuna in the western Pacific (Indian Ocean Fisheries Commission, Indo-Pacific Fisheries Commission, South Pacific Commission, South Pacific Forum Fisheries Agency, and others) have shown some interest in swordfish , but work in the eastern Pacific has been more limited. Given the absence of important commercial longline and/or swordfish fisheries among the coastal countries, the lack of interest is understandable. Ecuador and Costa Rica deploy longliners, but until recently have landed little swordfish.[396] Mexico has been the only country with a directed swordfish fishery in the central eastern Pacific (FAO area 77) and the fishermen currently use driftnets.[397] Chile is the only coastal country with a directed swordfish fishery in the southeastern Pacific (FAO area 87) and the fishermen use both longlines and driftnets. In addition there are only a small number of distant-water countries actively targeting swordfish (primarily Japan and Spain).

The primary multi-lateral groups active with fisheries in the eastern Pacific are:

Commission Permenente del Pacífico Sur: The CPPS helps to coordinate policies of the four member countries (Colombia, Ecuador, Peru, and Chile). The CPPS is often used by the members as a vehicle for policy statements on law of the sea, trade, and other matters and for coordinating research and other joint activities. The authors know of no joint activities specifically on swordfish. CPPS members do plan to discuss in 1997 a possible joint research effort of the Humboldt Current as a large marine ecosystem (LME)

Eastern Pacific Ocean Tuna Organization: This organization was created in 1995 as a result of a long series of negotiations by Latin American countries. The negotiations were sponsored by the Organización Latinoamericana de Desarrollo Pesquero (OLDEPESCA). The agency is not yet active and, if and when it begins work, will almost certainly focus primarily on tuna. Swordfish would likely be a low priority, if addressed at all.

International Symposium: Researchers from various countries are expanding work on swordfish, in part because of the increasing fishing pressure and concern over Pacific stocks. Most researchers believe that given the highly migratory nature of the fish, a full understanding of the stock structure and any future management regime will require a cooperative international effort. The first international symposium on Pacific swordfish was held in Ensenada, Mexico in 1994. The second symposium was held in Hawaii, United States in 1997. Colombian researchers did not participate in either session.

Inter-American Tropical Tuna Commission (IATTC): Costa Rica and the United States in 1949 agreed to subscribe to a convention creating the IATTC. Several Latin American and distant-water countries subsequently subscribed to the treaty. IATTC helped to manage the ETP tuna resources. Colombia never joined the IATTC because, until recently the country had no commercial tuna fishery. As Colombia in recent years has developed an important commercial tuna fishery, officials have expressed increasing interest in IATTC membership.[398] IATTC has two primary programs, of which one is the Tuna Billfish Program. While the primary focus has been on tunas, some research has also been done on swordfish and other billfish.[399]

Colombia participated in the negotiations of the international convention on straddling fish stocks and highly migratory species conducted during 1994 and 1995. A convention was finally adopted by a United Nations conference on August 4, 1995. Colombia did not sign the treaty and as of December 1996 had not ascribed.

2. Bilateral

Colombia has significant bilateral fishery interests. Colombia's two coasts and extensive insular territories have necessitated the most complicated series of boundary delimitation treaties in Latin America. In addition, the country conducts the largest licensing program for foreign fishing vessels in Latin America. Most Latin American countries have generally adopted highly restrictive licensing regimes or restricted foreign fishing completely. Colombia, because of its small domestic fleet, regularly licenses 100-200 foreign fishing vessels annually to assure an adequate supply of raw material to domestic seafood processing plants. (See "Agencies and Policies".) The Colombian licensing program involves a great many foreign countries in a variety of fisheries off Colombia.[400] Several of those countries are involved in tuna fisheries, some of which are believed

to take small amounts of swordfish. The marine boundaries with many different countries, the extensive licensing program, and the operations of unlicensed fishing vessels have also resulted in extensive bilateral contacts with foreign governments and companies.

Details on bilateral relations with individual foreign countries follows:

Belize: Colombian companies in 1995 reported association contracts for five Belize-flag tuna vessels, operating in both the Caribbean and Pacific out of various ports. The companies involved were Compomar, COPESCOL, and Carlos Eduardo Castrillon (appendix A5c). These vessels appear to be purse seiners and apparently have flag-of-convenience registrations and are not owned by Belizian nationals.[401]

Canada: A least one Colombian company (COPESNAR) in 1977 was discussing possible Pacific longline association arrangements with Canadian longline operators.[402]

China: Colombia reported that two Chinese vessels worked in association with COPESNAR in 1996 (appendix A6c). Chinese longliners operating off Latin American are unusual. More commonly such vessels are from Taiwan. Increasingly close economic and commercial ties are developing between China and Taiwan, despite the still hostile political situation. It is possible that these vessels could be Taiwan owned.

Costa Rica: Colombia and Costa Rica signed a marine boundary treaty on March 17, 1977, that included provisions for fisheries cooperation.[403] The authors, however, know of no substantive cooperative projects which ensued.

Cuba: Cuba is one of the few Latin American countries deploying distant-water fishing vessels, including longliners targeting tuna and swordfish.[404] Cuban longliners were active off Colombia and Venezuela during the 1960s, targeting primarily yellowfin tuna.[405] No information is available on possible swordfish by-catches. No Cuban vessels are currently believed to be active off Colombia. The longline fleet in recent years has operated in Cuban waters and in the Atlantic, including grounds off west Africa. Fuel shortages in the early 1990s restricted operations, but more recent reports from Cuba suggest the country's longline fleet is becoming more active.[406]

Cyprus: One Cyprus-registered vessel was deployed off Colombia in 1991. The purse seiner continued active through 1995, in association with COPESCOL. The vessel operated in the Pacific out of Buenaventura (appendix A5b). It is unclear what happened when COPESCOL closed. Cyprus is a major center for flag-of-convenience registrations, but the owners of the vessel are unknown.[407]

Dominican Republic: Colombia signed a marine boundary treaty with the Dominican Republic in 1978.[408]

Ecuador: Colombia and Ecuador signed a marine boundary agreement on August 23, 1975.[409] The agreement included provisions for fisheries cooperation, but the authors know of no significant ensuing cooperative projects. Ecuador deploys one of the more important Latin American tuna fleets. The Ecuadorean fleet is composed mostly of small seiners. The small Ecuadorean seiners operate primarily in Ecuadorean waters, but several are also regularly deployed in Colombian waters. Several Colombian companies (Atunec, Atunes de Colombia, COPESCOL, Frigopesca, and MARCOL) in 1995 had association agreements with many Ecuadorean vessel owners (appendix A5b). There is unlikely to be any significant swordfish by-catch as only seiners are involved. Ecuador in recent years has also deployed a small, but expanding longline fleet targeting tuna. Ecuador's longline fleet is currently reporting increasing swordfish catches and several longliners are targeting the species (Ecuador, appendices B2a and B2b2). Operations targeting swordfish are currently reported to the west of the Galápagos, well outside of Colombian waters.[410] Colombian sources report that Ecuadorean tuna seiners targeting tuna in the past operated illegally around Colombia's Malpelo Island. (See "Enforcement".) None of these longliners have obtained Colombian licenses. One Colombian observer reports that Ecuadorean longliners have also operated around Malpelo Island, but have not done so for the past few years.[411]

European Union: Colombia and the European Union (EU) have discussed fisheries as part of on going diplomatic exchanges.[412] Colombia's primary interests are access to the EU market for seafood exports and possible technical assistance. The Europeans are primarily interested in access to Colombian fishing grounds. The EU during the 1990s granted Colombia duty-free access for some seafood, including tuna, as part of a wider arrangement with Andean countries to help combat drug smuggling.[413] Some EU members complained, however, when several Colombian and Ecuadorean companies reportedly began exporting foreign tuna to take advantage of the reduced duties.[414] The authors know of no priority access granted for EU fishing vessels, but Spanish seiners do fish tuna off Colombia in association with Colombian companies (COPESCOL and Frigopesca) (appendix A5b). Spanish longliners are targeting swordfish in the

southeastern Pacific out of Peruvian ports.[415] The authors know of no swordfish or tuna longlining by Spain or other EU countries off Colombia.

Haiti: Colombia signed a marine boundary treaty with Haiti in 1978.[416]

Honduras: Colombia and Honduras signed a marine boundary agreement in 1986.[417] The agreement, however, has not yet been ratified by Honduras because of domestic opposition over recognizing Colombian jurisdiction over the western Caribbean islands off Honduras and Nicaragua. Many Honduran vessels have obtained Colombian licenses to work in association with Colombian companies, primarily for lobster.[418] Only one of those vessels in 1995, however, was licensed for tuna, the *Pampano I*. The vessel worked with Ramón Elias Vitery in the Pacific out of Tumaco (appendix A5c). No details are available on the vessel or its operations. Honduras is a major Latin American center for registering flag-of convenience vessels, including many commercial longliners.[419] The *Pampano I* was a relatively small vessel, however, and could have been Honduran-owned. It is unclear why none of the Honduran flag-of-convenience tuna vessels have been deployed off Colombia. The authors note that vessels from several other countries (Belize, Cyprus, Panama, St. Vincent, and Vanuatu) making flag-of-convenience registrations are deployed off Colombia (appendix A5b and d and photo 27).

Jamaica: Colombia signed a fisheries agreement with Jamaica in 1981 after more than 10 years of negotiation. The treaty provided Jamaican artisanal fishermen access to Colombian waters, including the area around Bajo Nuevo and Seranilla.[420] The agreement did not go into effect until 1984 and apparently expired in 1986. The two countries have negotiated a marine boundary agreement which entered into force in 1994.[421]

Japan: Japanese distant-water tuna longline fishermen have operated off Colombia along both the Caribbean and Pacific coasts. Two other companies, Bahia Cupica and Pescaderia Asturiana, report working with Japanese longliners in the Pacific and Caribbean/Atlantic (appendix A7). These two companies report that the Japanese operations are not restricted to the Colombian EEZ, even though they have obtained Colombian licenses. The associated Colombian companies report that the Japanese vessels land very little swordfish (appendix B4).[422]

Caribbean/Atlantic: In the Caribbean, the Japanese reported substantial stocks of billfish (sailfish and spearfish) off Colombia and other western Caribbean countries during the 1960s and 70s, before many 200-mile coastal zones were established. One observer during 1972 reported Japanese longliners operating 11-13°N, 76°W.[423] No information on the target species is available, but it was presumably tuna. The Japanese have reported limited swordfish and billfish catches in addition to tuna off Colombia's Caribbean coast during the 1990s.[424] The Colombian companies associated with the Japanese vessels, however, report virtually no swordfish catch (appendix B4).

Photo 27.-- The Vikingos company in Cartagena leased Russian-built trawlers with Panamanian flag-of-convenience registries. Eduardo Pastor

Pacific: In the Pacific, Japanese tuna longline fishermen report swordfish catches in their operations off Colombia and Ecuador, both within and outside the 200-mile zones.[425] INPA reports that Colombian companies worked with six Japanese vessels licensed for tuna in 1995, although few details on the vessel types are available (appendix A5b). All but one of the vessels worked in the Pacific out of Buenaventura with COPESCOL, FRIGOPESCA/Vikingos, and INPESCA. INPA reported only four Japanese vessels associated with Bahia Cupica (three vessels) and Frigopesca (1 vessel). FAO reports Japanese swordfish catch data by large

oceanic areas. The coast of Colombia is the northern-most limit of FAO area 87 and the southern-most limit of FAO area 77. Thus the results Japan reports in these two areas give some indication of Japanese swordfish catches in and near Colombian waters. Japan reported a catch of over 900 t during 1988 in FAO area 87. The 1994 catch was less than 700 t in 1994 (Latin America, appendix C2b). Given fishing patterns reported by the Japanese, little of this swordfish appears to have been taken in Colombian waters, but rather further south off Peru and west out into oceanic areas of the Pacific.[426] Japan reports a more substantial catch of swordfish in FAO area 77, as much as 4,000 t in 1988. The catch by 1993, however, had declined to only 1,600 t (Latin America, appendix C2b). FAO area 77, however is a very large area extending well out into the central Pacific where most of the Japanese catch was taken.[427] More precise data by fishing area shows that the Japanese and other distant-water fishermen have reported relatively poor swordfish catches in Colombian waters. The Japanese and other foreign fishermen have reported no longline effort in the eastern area of Colombia's Pacific EEZ for many years. They have reported generally limited swordfish, but good-to-moderate marlin catches in the western sector of Colombia's 200-mile zone and to the west and south of Colombian waters.[428]

Korea: Korea attempted to negotiate fishery agreements with Colombia and other South American countries during the late 1970s.[429] The Koreans experienced little success. Data reported by the Koreans suggest that their longliners took little swordfish in operations around Latin America. Korea has reported no swordfish catch in the western central Atlantic (FAO area 31) since 1990 and the small catches during the 1980s were probably not taken off Colombia. Korea has not reported any swordfish catches in the Pacific off South America (FAO area 87) since 1981. Korea reports a minimal catch of swordfish in the central eastern Pacific (FAO area 77), only 13 t in 1994 (Latin America, appendix C2b). FAO area 77 includes the area immediately north of Colombia off Central America, which is a very large area extending well out into the central Pacific.[430] The Korean Pacific longline fishery varies seasonally, but is concentrated from 10°N-25°S, primarily in the western and central Pacific. Some effort, however is also deployed in the ETP, including occasional longlining in Colombian and Ecuadorean waters. Korea has for years deployed tuna and other fishing vessels off Colombia. The Korean tuna longline fleet, for example, reported extremely good catches in Colombian and Ecuadorean coastal waters during 1988 and moderate to good results in the area (including the western portion of the Colombian EEZ) during 1991, especially for bigeye.[431] The Koreans have not, however, reported any longline effort in the Caribbean during recent years. FRIGOPESCA, now part of Vikingos, reported association contracts with two Korean tuna vessels in 1995. Both were deployed in the Caribbean out of Cartagena (appendix A5c). The vessels may have been longliners, but no details are available.[432] The catch may have been reported as Colombian rather than Korean catch. INPA reported no associated Korean tuna vessels in 1996.

Mexico: Mexico and Colombia agreed to a fisheries technical cooperation program in 1983.[433] No details are available on any ensuing cooperation, if any. The two countries have also discussed possible joint tuna ventures. (See "International: Joint ventures".) The authors know of no actual joint ventures, but Mexican tuna seiners, both licensed and unlicensed, do regularly fish off Colombia. Three Colombian companies worked with six Mexican tuna vessels during 1995, but only one in 1996. The primary Colombian company that worked with the Mexicans during 1995 was Industrial Pesquera C/Biana (appendix A5c). Almost all of the Mexican vessels were large, modern tuna purse seiners and they were deployed in both the Caribbean and Pacific. The only Colombian company associating with a Mexican seiner in 1996 was Vikingos (appendix A6c).

New Zealand: Coltuna worked in association with one New Zealand tuna vessel during 1995. Operations were conducted in the Pacific out of Buenaventura (appendix A5b). A New Zealand company already operating out of Ecuador has contacted potential Colombian partners concerning possible future longline ventures (Ecuador, photo 22). The New Zealand company already has a joint venture in Ecuador.[434]

Panama: Colombia and Panama have signed a marine boundary agreement.[435] Large numbers of Panamanian fishing vessels fish off Colombia, primarily for shrimp and tuna.[436] Colombian companies worked in association with 14 Panamanian tuna vessels during 1995. Operations were conducted in both the Caribbean and Pacific (appendix A5b). Several of the vessels were purse seiners, but details on many of the vessels are unavailable. Panama is known to register many flag-of-convenience vessels, but information on the owners of these vessels is limited.[437]

Russia: Frigomarina worked with two Russian Tibiya class vessels for tuna during 1995. The vessels were deployed in the Pacific out of Buenaventura (appendix A5b). The Soviet Union attempted to develop a profitable tuna fishery during the 1980s, but never

succeeded. It is unclear why these vessels were deployed for tuna off Colombia. The authors note that since the breakup of the Soviet Union in 1992, small numbers of small fishing vessels (including some recently built in Russian shipyards) have been deployed in Panama, Peru, and other Latin American countries (photo 17). The vessels often have flag-of-convenience registrations, especially Panamanian.[438]

St. Vincent: Frigopesca worked with two St. Vincent-flag vessels for tuna in 1995. St. Vincent also registers flag-of-convenience vessels.[439] They were deployed in the Caribbean out of Cartagena (appendix A5b).

Spain: Spanish fishermen in 1993 reported no swordfish fishing off Colombia.[440] COPESCOL and FRIGOPESCA worked with three Spanish vessels on tuna during 1995, presumably purse seiners, in both the Caribbean and Pacific. The Spanish do not report any swordfish catch in the Pacific (Latin America, appendix C2b). Spanish vessels, however, are known to be operating for swordfish in the southeastern Pacific, off Peru and Chile.[441]

Taiwan: Taiwan reports no swordfish catch in the southeastern Pacific (FAO area 87), but has a small swordfish catch in the western central Atlantic (FAO area 31). Taiwan reports operations in the central Pacific, but not in the ETP along the Pacific coast of South America. Reports for 1992, the most recent year available to the authors, show no Taiwan longline catches east of 110°W. The closest billfish (including swordfish) catches to the South American coast were reported during January, east of 110°W between 15-20°S, latitudes off southern Peru.[442] Taiwan reports a substantial swordfish catch in FAO area 77, just to the north of Colombia's Pacific EEZ. Taiwan catches totaled 870 t in 1994, an all-time record (Latin America, appendix C2b). FAO area 77, however is a very large area extending well out into the central Pacific. It is unclear to the authors just where in this area the Taiwan catch has been taken. Taiwan catch data in 1992 does not show good billfish yields in this area.[443] There is also no Taiwan swordfish catches along Colombia's Caribbean coast. Taiwan in 1992 reported no longline fishing for any species in the Caribbean, although there were two transshipment points (St. Maarten and Trinidad) for fish Taiwan fishermen have caught in the Atlantic.[444] No Taiwan-flag tuna vessels were licensed by Colombia in 1995 and 1996, presumably because Colombia recognizes mainland China. It is possible that some of the flag-of-convenience vessels mentioned above are in fact Taiwan-owned vessels, probably longliners.[445] Colombian observers, however, insist that only Japanese flagged or owned longliners are active off Colombia (appendix A7). INPA reported that two Chinese vessels worked with COPESNAR in 1996 (appendix A6d).

United States: The United States and Colombia in 1972 negotiated the Saccio-Vázquez Treaty, concerning the status of the Caribbean cays and banks of Quita Sueño, Roncador, and Serrana. Under the terms of the Treaty, which entered into force in 1983, U.S. fishermen may fish the Treaty waters, but are subject to reasonable conservation measures applied by Colombia. Such regulations must be non-discriminatory and no more restrictive than those applied to domestic Colombian or other foreign fishermen. U.S. fishermen, however, have primarily expressed an interest in reef species such as snapper, grouper, lobster, and conch. Available reports on U.S. longline fishermen from 1992-95 show no U.S. swordfish operations off Colombia's mainland coast. The only U.S. activity in the southwestern Caribbean was reported during 1992 and consisted of limited effort off Nicaragua's Corn Islands to the west of Colombia's San Andrés Island. Most of the U.S. Caribbean longlining is in the northern Caribbean near the passages to the Atlantic. Much more extensive U.S. fishing takes places in the Gulf of Mexico and along the U.S. Atlantic coast.[446] Such data, however, does not necessarily indicate whether swordfish are present because the decision not to fish reflect the access policies of the coastal state. The virtual total absence of effort, however, strongly suggests that U.S. fishermen believe that swordfish are probably not present in commercial quantities in the Caribbean. U.S. longliners are not currently active along the Pacific coast of South America, although there has been some limited activity in previous years.[447] At least one Colombian company (COPESNAR), however, is 1997 reported discussions with U.S. longline operators concerning possible association contracts.[448] Colombian companies (primarily Frigogan) worked with eight U.S. tuna seiners during 1995. The purse-seine operations were conducted in the Pacific out of Buenaventura (appendix A5b). The number of U.S. seiners declined to four in 1996 (appendix A6c).

Vanuatu: Numerous Vanuatu-flag tuna vessels operate off Colombia. As many as 35 licenses have been issued in a single year (appendix A5b). Colombia granted 11 tuna licenses in 1995. The Vanuatu vessels worked primarily with Atunes de Colombia. The vessels involved are large purse seiners so no significant swordfish by-catch is involved.

Venezuela: Venezuelan tuna fishermen operate extensively off Colombia. Several different Colombian companies worked with 17 Venezuelan tuna vessels during 1995 (appendix A5b). The vessels

were large purse seiners so no significant swordfish by-catch would be involved. Venezuela also has a tuna and swordfish longline fishery, but it primarily focuses on the central and eastern coast and not the western coast along the Colombian border.[449] (See "Fishing Grounds".)

B. Joint ventures

Colombia's fishing industry remains basically closed to foreign involvement. Industry representatives report overtures from foreign investors (primarily French, Italian, and Spanish) for joint ventures. The terms offered under Colombian law, however, have discouraged most prospective investors.[450] The authors know of only a few fishery joint ventures, even in the large tuna sector. There are no joint ventures involved with swordfish.

Ecuador: Several Colombian companies (like now closed COPESCOL) which have built tuna processing plants have relied heavily on Ecuadorean tuna seiners to supply raw material (appendix A5b and A6c).[451] The Ecuadorean seiners have played an important role in supplying Arpecol, ATUNCOL, Atunec, Cimar, Coltuna, COPESCOL, Dispa, Frigopesca, Marcol, Supertuna, and Vikingos (appendices A5b and A6c). These companies contracted 27 Ecuadorean seiners in 1995 and 23 seiners in 1996. The arrangements involved appear to be informal, oral arrangements with individual Ecuadorean vessel owners rather than formal joint venture with Ecuadorean companies.

Japan: A Japanese company (Kanematsu Kosho) and a Colombian partner (unidentified) formed the Intermar Compañía Internacional Marítima Pesquera (INTEMAR) in 1974. The company was a majority (60 percent) Colombian-owned operation. The Japanese partner provided two vessels and some crew members, but most of the crew was Colombian. Operations focused on yellowfin, skipjack, and bonito for canning.[452] At least some of the operations involved live bait fishing.[453] No details are available on swordfish catches, but as live bait operations were involved, it was likely minimal.

Mexico: A Mexican shipyard, Industria Astillera Monarca, in 1984 entered a joint venture as part of an effort to sell fishing vessels, primarily shrimp and fish trawlers.[454] The Mexican state-owned fishing company, Productos Pesqueros Mexicanos (PPM), and Colombian private companies in 1983 agreed to a tuna joint venture to initiate exploratory fishing.[455] The agreement was not publicized in Colombia.[456] The initial agreement, however, does not seem to have resulted in the formation of any joint companies.

Poland: A Polish state fishing company (GRYF) in 1976 initiated a 2-year feasibility study involving test fishing along Colombia's Pacific coast. Two Polish vessels were deployed off Colombia. The Poles shared results with the Colombian company Pensco-Lombias/Pescolombia. The species involved included tuna. The results of the test fishing apparently were not sufficiently attractive to interest the Poles in an actual equity joint venture, especially as they concluded that any operation in Colombia would require extensive training and a greater involvement than the Poles concluded was financially feasible. The Colombians for their part were concerned about the large vessels which the Poles wanted to deploy.[457]

Spain: Press reports indicated that in 1982 Colombia and Spain were to sign a fisheries agreement to promote joint ventures between fishing companies.[458] Few details are available, however, on actual joint ventures. One venture reportedly formed was Operaciones Integrales de Pesca (OPI), which was to provide tuna and shrimp vessels for fishing operations off Colombia. OPI was 51 percent owned by the Colombian partners.[459]

Sweden: A Swedish company (Norfish) in 1988 reportedly acquired East German-built fishing vessels operated by a Danish company and deployed them off Colombia out of Buenaventura.[460]

United States: U.S. tuna companies have agreed to a variety of contracts with Colombian tuna companies like FRIGOPESCA/Vikingos to loin tuna. These agreements appear to be simple commercial contracts without any equity investments in joint companies.[461]

C. Foreign assistance

A variety of countries and international organizations have provided fisheries assistance to Colombia. Much of that assistance has been directed at the large artisanal sector. The authors, however, know of no assistance programs which have directly promoted fisheries for swordfish and other billfish.

Canada: The Canadian International Development Agency (CIDA) during the 1970s and 1980s provided assistance for training and developing artisanal fisheries.[462] The Canadian International Center for Research on Development (CIID) has also helped fund a fisheries development program focusing on artisanal fishermen.[463]

European Union: The EU and Colombia signed a technical assistance agreement in 1988. The EU provided technical support to INDERENA, assisting in the design of a national fisheries development plan and strengthening fisheries administration.[464] The EU and four South American countries (Colombia, Ecuador, Peru, and Venezuela) in 1993 agreed to a 5-

year fisheries technical cooperation program, Programa de Cooperación Técnica para la Pesca (VECEP).[465] The program has included assistance to artisanal fishermen and small enterprises as well as the financing of a vessel for test fishing in the Caribbean.[466] (For details see "Italy".)

FAO/UNDP: The United Nations has provided some fisheries assistance in developing marine fisheries during the 1960s and 70s. Much of the work dealt with freshwater fisheries and aquaculture.[467] There was also some limited work on marine fisheries--including marine stock assessments and test fishing.[468] As part of the Western Central Atlantic Fisheries (WECAF) program, an FAO specialist prepared an assessment of the artisanal fisheries along the Caribbean coast and on the offshore Caribbean islands.[469] FAO coordinated a fisheries development program in the early 1980s.[470] FAO assistance, however, has been limited, primarily because fisheries was a low priority for Colombia until recently. FAO prepared an assessment of Colombian fisheries in 1986.[471]

Italy: Italy is financing the INPA/VEEP project which is experimenting with surface longlines for artisanal fisheries along the Caribbean coast.[472]

Japan: Japan has for several years been sponsoring a series of relatively low budget fishery projects, primarily along the Pacific coast. Japan offered a $2 million fisheries loan in 1977 to create a training center and purchase a vessel.[473] The Japanese in 1979 provided $3 million for training artisanal fishermen.[474] The Japanese Government also helped finance a $3.7-million fisheries development project in 1984 at Tolu along the Pacific coast. The project targeted the development of fisheries for offshore resources.[475] Japan has provided some fisheries assistance through a technical cooperation agreement. The Japanese International Cooperation Agency (JICA) from 1988-91 assisted several participating agencies (a regional development corporation, education and science agencies, and INVEMAR) open a fisheries training center at Buenaventura.[476] Japan in 1989 approved a $6-million grant to finance a coastal fisheries development project, building a boat repair shop, constructing an ice plant, and improving training facilities at Buenaventura.[477] Another port project at Bahia Solano was discussed in 1988.[478]

Netherlands: The Dutch International Technical Corporation helped fund the improvement of artisanal fishing facilities at Cartagena in 1988.[479]

Taiwan: Colombia and Taiwan signed a technical cooperation agreement on fisheries in 1976.[480] Taiwan provided experts to Colombia, primarily on aquaculture.[481] Taiwan assistance apparently ended when Colombia recognized mainland China.

United States: Almost all U.S. fisheries assistance to Colombia has dealt with aquaculture.

Other: Several Scandinavian countries report some activity in Colombia. The primary interest appears to be sales promotions for fishery products and services from various Scandinavian countries. The vessels involved were mostly trawlers.[482]

XVII. Enforcement

Colombia's primary enforcement difficulties involve incidents with fishing vessels from neighboring Ecuador, Panama, and Venezuela. The difficulties with Venezuela are particularly significant because the two countries also have a long-standing marine boundary dispute. In addition, there are some serious difficulties with Nicaragua, also complicated by conflicting jurisdictional claims. None of these difficulties appear to involve longline fisheries for oceanic pelagics. Some of these incidents have involved the Colombian navy firing on the foreign fishermen when they attempted to evade seizure. The navy reported firing on five foreign tuna vessels in 1980 that evaded seizure.[483] Despite this incident, there appear to be relatively few incidents involving foreign distant-water tuna vessels, either purse seiners or longliners.

Available information on incidents with foreign countries are as follows:

China: The authors know of no incidents involving Chinese vessels.

Cuba: A few Colombian vessels operating from the offshore islands were seized by Cuba during the 1970s. The fishermen involved received lengthy jail terms and complained of "miserable food and whippings."[484] The authors have no information on recent Cuban seizures of Colombian vessels.

Ecuador: Colombia reports occasional seizures of Ecuadorean tuna seiners, many of which have mixed Ecuadorean-Colombian crews. A few Ecuadorean fishing vessels have been used to smuggle arms, such as the *Bellamar* seized in 1988.[485] Most of the seizures, however, involve actual fishing vessels. Colombian officials seized three Ecuadorean tuna seiners (*Rumancho*, *Saturno*, and *North King*) about 50 km south of Malpelo Island in 1987.[486] Ecuadorean authorities have seized a smaller number of Colombian vessels, mostly shrimp trawlers such as the *Taganga* seized in 1979.[487]

Honduras: Occasional seizures of both Honduran fishing vessels and foreign vessels with Honduran flag-of-convenience flags have been noted. One Honduran vessel with 40 fishermen was seized in 1984 off Quita Sueño.[488] Like Nicaragua, Honduras has not negotiated a marine boundary agreement with Colombia and does not recognize the Colombian claim to the offshore islands in the western Caribbean.

Japan: The authors have noted no recent seizures of Japanese vessels, but available data is incomplete. The Japanese Government has taken some enforcement action of its own. In one incident, the Government in 1994 initiated legal action against three Japanese companies which fished tuna off Colombia and Ecuador without the proper Japanese permits. The catch taken by these vessels was reportedly transshipped to Japan through unidentified Central American ports.[489]

Korea: The authors have noted no seizures of Korean vessels, but the available data is incomplete.

Mexico: There have been a few seizures of Mexican tuna seiners, primarily along the Pacific coast. One seiner was seized near the Panamanian marine boundary during 1987.[490] Mexico now operates the largest tuna purse-seine fleet in the ETP. One incident was reported in the Caribbean, but these were apparently small vessels being transferred from Mexico's Pacific to its Gulf of Mexico coast and were not fishing.[491]

Nicaragua: Nicaragua's Sandinista Government in the 1980s began seizing Colombian fishing vessels operating in the waters around San Andrés and Providencia and the other islands and cays which both countries claim.[492] Nicaragua subsequently seized several Colombian fishing vessels.[493] Nicaraguan patrol boats on several occasions during the 1980s fired on Colombian fishermen. Some individuals were wounded and others reported missing.[494] Colombia responded by seizing Nicaraguan vessels.[495] The situation was further complicated by smugglers using fishing vessels to move across the undelimited Colombian and Nicaraguan frontier.[496] Such incidents have declined in recent years, but occasional incidents are still reported. Colombian fishermen continue to complain of arbitrary arrests, "abusive" treatment, and even torture.[497] The incidents involve both artisanal and commercial fishermen. Processing plants on San Andrés complained during 1994 that the Nicaraguan enforcement actions were adversely affecting their operations by interrupting the landing of raw material.[498] Nicaragua has reported several recent seizures. Nicaraguan authorities, for example, seized two Colombian vessels during 1995: *Sea Dog* (March 19) and *Miss Tina* (April 5). The seizures appear to have occurred near San Andrés in waters claimed by both countries.

Panama: Occasional seizures by both Colombian and Panamanian authorities have been noted. Colombia has seized both Panamanian fishing vessels and foreign vessels with Panamanian flag-of-convenience flags. Most of the Panamanian vessels seized are

shrimp trawlers.[499] One Panamanian vessel in 1986 was charged with violating a nature reserve.[500] Panamanian authorities have reported seizures of many types of Colombian vessels. One 1993 report indicated a seizure of a snapper vessel and seiner. The Panamanian patrol officer told journalists, "What better way for Panamanian sailors to mark their day (the patron saint of sailors) than with a capture such as this one."[501] Press reports indicated that a Panamanian patrol boat seized two Colombian fishing vessel near the Perlas Archipelago on April 9 and 11, 1995.[502]

Taiwan: The authors have noted no seizures of Taiwan longliners, but the available data is incomplete. A Taiwan vessel, the *Shin Fa 12* operating by the PZP company had its licenses revoked in 1991 for fishing in inshore waters, but the vessel appears to have been a trawler.[503]

United States: Colombia has seized a few U.S. fishing vessels, such as the *Bon Chance* in 1981, which was operating with a mostly Colombian crew.[504] Two U.S. vessels in 1986 were charged with violating a nature reserve.[505] The shrimp trawler *Pices* was seized in 1987.[506] A few seizures have been reported around the Colombian offshore islands. The *Silk Ridge* was seized in 1981.[507] Many of these problems were resolved in 1983 when the treaty granting U.S. fishing rights to the waters in the Caribbean around Quita Sueño, Roncador and Serrana came into effect. (See above.) Occasional incidents, however, have continued, such as the seizure of the *Prospector I* in 1985, the *Gladiator* in 1987, the *Osprey* in 1988, and others.[508] There have also been a few seizures of other U.S. vessels in the San Andrés Providencia area, but the circumstances of some, such as the *Sitex-7* in 1992-94, are very complicated.[509]

Venezuela: Numerous Colombian fishing vessels were seized by the Venezuelans during the 1980s. The Colombian fishing company Vikingos reported in 1986, for example, that 41 of its vessels, mostly shrimp trawlers, were being "harassed."[510] Some of the vessels seized are foreign vessels leased by Colombian companies, such as *Makandra 21* and *Se Chong 19* leased by Vikingos in 1986.[511] Three Colombian fishermen were killed in a violent 1988 incident.[512] The problem is especially difficult because the two countries have been unable to agree on a border delimitation treaty. Incidents with Venezuela have declined somewhat in recent years, but some serious incidents were reported in 1995. Venezuelan officials seized two Colombian fishing vessels on August 31 and September 16, 1995. Colombian authorities have also seized a few Venezuelan fishing vessels. One of the few Colombian seizures noted recently has been the detention of the Venezuelan fishing vessel *Gavilán* south of San Andrés on October 7, 1995. The vessel was operating under contract to the Nicaraguan company Marinca and included Peruvians and Nicaraguans in the crew. The seizure was complicated by an incident the following day when Venezuelan Air Force helicopters entered Colombian territory, spoke with Colombian television journalists, fired shots in the air, and then returned to Venezuela. The same day guerrillas operating along the border ambushed a Venezuelan National Guard patrol. Government officials in both countries generally try to play down fishing vessel incidents, but the national press often runs highly sensational accounts. Considerable press attention, for example, was given to the Venezuelan seizure of two vessels in 1995. One vessel, the *Redes 9* was reportedly fired on 30 times.[513]

Other countries: Colombian authorities have reported occasional seizures of vessels from other countries. Jamaican artisanal fishermen were fishing on the Pedro Banks, but strayed into Colombian waters.[514] The British trawler *Rosalinda* was seized off San Andrés and Providencia in 1989.[515]

In addition to seizures by foreign countries, Colombian and foreign fishermen have faced assault and murder by anti-government insurgents, drug traffickers, and robbers. These incidents appear to have declined somewhat in recent years, although the authors have only limited information. Such groups found fishing vessels potentially useful for transport and smuggling. Insurgents in 1988, for example, killed eight Colombian fishermen in Antioquia. The fishermen reportedly refused to cooperate with the insurgents.[516] Drug traffickers, like old time pirates, may seize a fishing vessel, kill the crew, and then use the vessel to smuggle drugs.[517] Major Colombian companies, such as Vikingos, have reported these attacks, often off the Guajira Peninsula. The Japanese vessel *Latin Maru I* was attacked in 1979.[518] The U.S. Coast Guard has seized several Colombian fishing vessels being used for drug smuggling, such as the *Argana II* seized in 1985. Other attacks motivated by robbery have been reported, such as a 1979 attack on the Ecuadorean shrimp trawler *Estrella del Mar*.[519] Reports from both Colombia and Venezuela indicate that this is a continuing problem of concern to the fishermen.[520]

XVIII. Future Trends

Colombia has made great progress since the late 1980s in modernizing its fishing industry. Existing companies have expanded operations and broadened their product line. New companies have been established to enter the ETP tuna fishery and processing industry. Several companies now have modern facilities capable of meeting demanding export standards. Despite this activity (the growing competence of Colombian companies, and the experience of artisanal longline fishermen) the country has not yet deployed a commercial longline fishery. Given the growing capability of domestic fishing companies and the demonstrated success of exporters in other areas, it seems likely that Colombian companies will eventually enter the longline fishery. A few companies have already attempted such operations and although unsuccessful are still optimistic that longline operations to supply fresh product to export markets is a viable undertaking. For the foreseeable future, such operations will probably require Colombian companies to contract foreign longliners. Purse-seine fishermen have demonstrated that there is a significant population of yellowfin tuna available. Any Colombian longline fishery might primarily target tunas. Swordfish does not appear to be abundant, but it is present and the actual size of the resource has no yet been determined with any certainty.

Note: This chapter was designed and formatted by Ebbon Allen, a sophomore at Morehouse College in Atlanta, Georgia. Mr. Allen worked with the National Marine Fisheries Service as part of the Oak Ridge Institute for Science and Research (ORIS) Program. He is majoring in English and is planning a career in journalism.

SOURCES

Alvarez-León, Ricardo. Projecto Manglares de Colombia, Ministerio de Medio Ambiente, personal communications, August 10, 1997.

Alzate Medina, Amparo. *Industrialización Pesquera en Colombia: Desarrollo y Perspectivas* (Medellin: Hollasa, 1988), p. 17.

Anzola, Nestor, Diego Muñoz, Monica Alfaro, and Laura Maria Blain. "Sea turtles in Buritaca-Don Diego, Colombia," *Marine Turtle Newsletter*, April, 1989, pp. 9-11.

Arocha, Freddy. Universidad de Oriente, personal communications, February 2 and 4 and July 1, 7, and 8, 1997.

Asis, Juan. Boat captain, personal communications, February 24, 1997.

Bailey, Kevin. Peter G. Williams, and David Itano, "By-catch and discards in Western Pacific tuna fisheries: A review of SPC data holdings and literature," *Oceanic Fisheries Programme Technical Report*, No. 34 (South Pacific Commission (SPC): Noumea, New Caledonia, 1996), p. 4.23.

Barbieri, M. Angela, Eleuterio Yáñez R., Luis Ariz A., and Antonio González C. "La pesquería del pez espada: Tendencias y perspectivas," in *Perspectivas de la Actividad Pesquera en Chile* (Escuela de Ciencias del Mar, UCV: Valparaíso, Chile, 1990).

Bentancourt, Javier. Manager, INPESCA, personal communications, February 20-21, 1997.

Bertolino, A.R. and G.P. Scott. "Standardized catch rates for swordfish (Xiphias gladius) from the U.S. longline fleet through 1992," *Collective Volume of Scientific Papers*, XLII (1) (ICCAT: Madrid, 1994), pp. 303-308.

Bigelow, Keith and Christopher Boggs. "Progress report to Pelagic Fishery Research Program (PFRP)," June 1996, internet posting.

Bogdanov, A.S. *Soviet-Cuban Fishery Research*, 1965, tanslated by NMFS, 1969.

Bogota Radio Candena Nacional, 1200 GMT, October 11, 1989.

Buenaventura, Boris. President, Pesymar, personal communications, March 21, 1997.

Canelos, Diego. Manager, Atunes de Colombia, personal communications, March 10, 1997.

Carocci, Fabio and Jacek Majkowski. *Pacific Tunas and Billfishes: Atlas of Commercial Catches* (FAO: Rome, 1996).

Cho, Naritoshi. "An attempt to clarify genetic stock structure of swordfish using nuclear gene markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

Cobo Cedeño, Mario. Director General, Instituto Nacional de Pesca, personal communications, March 26, 1997.

Columbian Government. Estatuo General de Pesca. Ley 13, January 15, 1990.

Cramer, Jean. "Large pelagic logbook newsletter-1994," *NOAA Technical Memorandum*, NMFS-SEFSC-378, November 1995.

_____. "Large pelagic logbook newsletter-1995," NMFS-SEFSC-394, November 1996.

D'Alarçao, J.P. J. Puig Aleu, C. Tapias R., and H. Naranjo O. *Notas Sobre la Pesca Artesanal en Colombia* (Bogota: UNDP/INDERENA, 1969), pp. 4, 7-9.

(The) *Daily Gleaner*, August 25, 1984.

Dollar, Robert A. "Annual report of the 1993 Western Pacific longline fishery," *Southwest Fisheries Center Administrative Report* H-94-06, August, 1994, 38 p.

De la Pava, Martha Lucia. INPESCA and Bahia Cupica, personal communications, April 11, 1995 and February 26 and March 24, 1997.

Eckert, Scott. Hubbs Sea World, personal communications, September 25, 1997.

Egiyan, G.S. "'Flag of convenience' or 'open registration' of ships," *Marine Policy*, March 1990, pp. 106-111.

Erazo, Bernardo. Production Manager, C.I.Oceanos, personal communications, April 21, 1997.

Escamilla, Freddy. Production Manager, Vikingos, personal communications, March 6, 1997.

FAO."Proyecto de pesca continental desarrollado en Colombia, 1959-60," *Programa Ampliado de Assistencia Tecnica*, N°1304 (FAO: Rome, 1961).

Felber, Craig. NMFS, personal communications, April 11, 1975.

FRIGOPESCA. "Programa de inducción para aspirantes a operarias 'proceso lomo de atún'," Cartagena, February, 1994.

García-Llano, Cesar Fernando. Programa de Biodiversidad y Ecosistemas Costeras, Instituto de Investigaciones Marinas y Costeras (INVEMAR), personal communications, August 22, 1997.

Giudicelli, M. "La pesca artesanal marítima en la costa Caribeña de Colombia: Su situación, sus posibilidades y su necesidades para el desarrollo," *Informe WECAF*, No. 8, August, 1979, pp.55

_____."Proyecto Inter-Regional para el Desarrollo de la Pesca en el Atlántico Centro-Occidental," *Informes WECAF*, No. 15, August, 1979, p.25

Godfrey, J. Stuart and Matthias Tomczak. *Regional Oceanography: An Introduction* (Pergamon: London, 1994), p. 314.

Gonzales, Porto Blanca and Luis Manjarres Martinez. Evaluación de una unidad pesquera artesanal que opero con red enmalle, palangre tiburonero y lineas mano," *Proyecto Integral de Investigaciones y Desarrollo de la Pesca Artesanal Maritima en al Area de Santa Marta: Informe Técnico Final*, Componente de Recursos y Captura (INPA/CIID/UNIMAGALENA: Magdalena, Colombia, 1933), pp. 145-164.

Gonzalez, Flover G. "Con tráfico de influencias diplomáticas," *El Espectador*, January 19, 1991.

Hall, Martín A. "An ecological view of the tuna-dolphin problem: Impacts and trade-offs," draft report, March 1997, tables 3-5.

_____. "On bycatches," *Reviews in Fish Biology and Fisheries*, Vol. 6, 1966, pp. 319-352, p. 335

Hernández, Armando. Executive Director, Cámara de la Industria Pesquera, personal communications, October 7, 1994 and March 10, 1997.

_____. "Dinamica del sector pesquero en los años 90," *ANDI,* March-April, 1995, pp.67-83.

Hernadez, Hortencia. Export Manager, FRIGOGAN, personal communications, February 19, 1997.

Humphreys, Robert. "Review of larvae and juvenile distributions with inference towards spawning habitat," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

Huaylinos, Pascual. "Le soplaron aire y ... !Bluuuumm!, *Oiga*, July 31, 1989, pp. 30-33.

IATTC. *Annual Report* (IATTC: La Jolla, California, 1994), pp. 95-98.

ICCAT. "1994 SWO background document: Figures," *Collective Volume of Scientific Papers*, XLIV (3) (ICCAT: Madrid, 1995), p. 91.

_____. *Report for Biennial Period,* 1994-95, Part II (1995), Vol. 2 (ICCAT: Madrid, 1996), pp. 53 and 58.

INDERENA. *Bases Para un Plan ..., op. cit.*

INFOPESCA "Convenio pesquero para procesamiento de atún," *Notas Comerciales*, February 20, 1989.

INPA. *Boletín Estadistico Pesquero*, 1995.

Jacobson, Donald and Dennis Weidner, "Soviet-Latin American Fishery Relations, 1961-89," *International Fishery Reports* (IFR-89/39), May 5, 1989, 153p.

Juhl, Rolf. NMFS memorandum, December 2, 1981.

Korean National Fisheries Research and Development Agency (NFRDA). "Fishery statistics and fishing grounds for the Korean tuna longline fishery, 1988~1992," *Technical Report of the NFRDA* (NFRDA: Seoul, December 1993), pp. 87, 300, and 314.

KYODO, various broadcasts.

Landa C., Antonio. "Datos sobre la pesqueria de atún aleta amarilla y barrilete en la zona económica exclusiva del Perú 1970-1977," *Rev. Com. Perm.*

Pacifico Sur, vol. 11, 1980, pp. 457-472.

Loreda, Nicolá. Deputy Director, Colombian Government Trade Bureau, Washington, D.C., personal communications, September 14, 1993.

Londoño, García Alejandro. INPA Director, personal communications, August 31, 1994.

Lozano, Jaime Bravo. Manager, ARPECOL, personal communications, February 19, 1997.

_____. Executive Director, Cámara Nacional de la Industria Pesquera, personal communications, October 7, 1994.

Loyaza, Eduardo. Personal communications, February 13, 1996

Mainero, Roman Augusto. President, Frigopesca, personal communications, January 18, 1995.

Magnusson, Magnus. Director, INFOPESCA, personal communications, March 23, 1990.

Majkowski, Jacek. Department of Fisheries, FAO, personal communications, April 7, 1997.

Manjarres, Luis. INPA/VECEP, personal communications, February 24, and April 17, 1997.

Marquez, Rene. Mexican National Turtle Coordinator, comments at Mexican-United States Fishery Cooperation Talks, September 25, 1997, Huatulco, Mexico.

Martínez, Antonio Chalela. Manager, COAPESCA, personal communications, February 27, 1997.

McDonald Checa, James. "Pesca para consumo humano directo," *El Comercio*, July 7, 1993, p. 2.

(El) Mercurio, various issues.

Moya, Alejandro. "Redención de la Costa Pacífica," *El Tiempo*, July 7, 1987.

Muñoz, Diego. Monica Alfaro, Laura Maria Blain, and Nestor Anzola. "Sea turtles in Buritaca-Don Diego, Colombia," *Marine Turtle Newsletter*, April, 1989, pp. 9-11.

Nakamura, I. "Billfishes of the world," *FAO Species Catalogue*, (125) Vol. 5, (FAO: Rome, 1985).

Nakano, Heideki. "An update of Japanese longline standardized CPUE for the Atlantic swordfish," *Collective Volume of Scientific Papers*, XLII (1) (ICCAT: Madrid, 1994), pp. 281-284.

Nakano, Hideki. "Review of data collection system for the Japanese longline fishery and problems about standardization of CPUE," *Collective Volume of Scientific Papers*, XLIII (ICCAT: Madrid, 1996), pp. 159-161

Nakano, Hideki. "Stock status of swordfish in the Pacific Ocean inferred from standardized CPUE of the Japanese longline fishery using general linear methods," in press as of March 1997.

Naranjo O, H. and J.P. D'Alarçao, J. Puig Aleu, C. Tapias R. *Notas Sobre la Pesca Artesanal en Colombia* (Bogota: UNDP/INDERENA, 1969.

Neyra Balta, Juan. "Atún y el desarrollo del Peru," *Pesca* (Peru), January-February, 1995, pp. 11-12.

Nippon Kokan and Marubeni in 1974 acquired a 20 percent equity share in CONASTIL. "Shipbuilding project in Colombia," KYODO, 1027 GMT, June 17, 1974.

Nisikawa, Honma. Yueyanagi and Kikawa. *Average Distribution of Larval Oceanic Species of Scrombroid Fishes, 1956-81* (Far Seas Fisheries Research Laboratory: Shimizu, Japan, 1985)

Noticias Argentinas (Buenos Aires), 1931 GMT, April 22, 1990.

Osbina, Adriana. Manager, Pescaderia Asturiana, personal communications, March 20, 1997.

Osbina, Roberto. Owner, Pesquera Asturiana, personal communications, March 21 and 24, 1997.

Padilla, Luis Alonzo. Coordinator of Marine Resource Evaluation, INPA/VECEP, personal communications, February 28, 1997.

Parker, Peggy. "South America looks to the future," *Seafood Business*, November/December, 1995, pp. 16-22.

Porter, Julie M. "Perspective on Atlantic (and Mediterranean) swordfish fisheries and assessments: The ICCAT experience," paper delivered at the Second International Swordfish Symposium, March 3, 1997, Turtle Bay, Oahu, Hawaii.

Presidencia de la Republica. Consejero Nacional de Pesca, *Programa PROPESCA*, *op. cit.*, p. 14.

Proyecto de Pesca Marítima. INDERENA-FAO as cited in INDERENA, *Bases Para un Plan de Desarrollo del Subsector Pesquero Colombiano*, undated but probably 1978, 274p.

Reeb, Carol and Barbara Block. "Genetic analysis of Pacific swordfish populations using mtDNA and microsatellite markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

Rey, Fernando. Subdirector General, Desarrollo y Ordenamiento Pesquero, INPA, personal commuication, March 11, 1996.

Rivera F., Jorge and Carlo Tassara. "Colombia: La capacitación en el sector pesquero artesanal," *EC Fisheries Cooperation Bulletin*, September 1991.

Robayo, Alvaro. MARCOL, personal communications, March 5, 1997.

Rodriguez, Armando Hernandez. Executive Director, Cámara Nacional de la Industria Pesquera, personal communications, October 7, 1994.

Rueda, A., José Vicente. "Dying turtles in Colombian waters still a mystery," Marine Turtle Newsletter, July 1990, pp. 4-6.

Sanner, Carol Jo. "The Marketing system of the artisanal fishery of the Cartagena Bay Area, Colombia," unpublished report prepared for the Centro de Investigciines Pesqueras, 1978.

Schroeder, Barbara. Sea Turtle Coordinator, NMFS, personal communications, February 24, 1997.

Seoul Radio, Haptong 0253 GMT, February 13, 1978.

Sosa-Nishizaki, Oscar and Makato Shimizu. "Spatial and temporal CPUE trends and stock unit inferred from them for the Pacific swordfish caught by the Japanese tuna longline fishery," *Bull. Nat. Res. Far Seas Fish.*, No. 28, March, 1991, pp. 77-85.

Tassara F.,Carlo and Jorge Rivera. "Colombia: La capacitación en el sector pesquero artesanal," *EC Fisheries Cooperation Bulletin*, September 1991.

(El) Tiempo, various issues.

Tobella, G.M. "Observaciones y conclusiones de la temporada de pesca de pez espada de 1967," Tesis, Esc. Cs. del Mar, Universidad Católica de Valparaíso, 1970, 74p. as cited in M. Angela Barbieri, Eleuterio Yáñez R., Luis Ariz A., and Antonio González C, "La pesquería del pez espada: Tendencias y perspectivas," in *Perspectivas de la Actividad Pesquera en Chile* (Escuela de Ciencias del Mar, UCV: Valparaíso, Chile, 1990).

Tobella, J.M. "La pesquería de pez espada (*Xiphias gladius*) en Chile," Tésis, Esc. Cs. del Mar, Universidad Católica de Valparaíso, 1964, 89p.

Tomzak, Mathias and J. Stuart Godfrey. *Regional Oceangraphy: An Introduction* (Pergamon: London, 1994).

Tovar M., Edmer. Buenaventura entró en la rea del atún," *El Tiempo*, January 24, 1989.

Tuna Research Center (TRC), *Annual Catch Statistics of Taiwanese Tuna Longline Fishery* (TRC/Institute of Oceanography/National Taiwan University: Taipei, December, 1993).

Umaña, Jaiduberto. Administrator, COPESCOL, personal communications, February 19, 1997.

Uozumi, Yuji and Kotoro Yokawa. "Country report of Japan for the swordfish fisheries in the Pacific Ocean," paper delivered at the Second International Swordfish Symposium, March 3, 1997, Turtle Bay, Oahu, Hawaii, p.6.

Uozumi, Y. "Preliminary analysis on the distribution of sailfish and longbill spearfish in the Atlantic Ocean in 1993 based on the logbook data," *ICCAT Collective Volume of Scientific Papers*, XLIV (3), SCRS/94/156 (ICCAT: Madrid, Spain, 1995), pp 26-29.

Uozumi , Y. "Swordfish by-catch by the Japanese longline fishery in the recent years," *Collective Volume of Scientific Papers*, XLII (1) (ICCAT: Madrid, 1994), pp. 285-287.

_____. "Swordfish by-catch by the Japanese longline fishery in the recent years," *Collective Volume of Scientific Papers*, XLII (1) (ICCAT: Madrid, 1994), pp. 285-287.

U.S. Consulate, Baranquilla, August 3, 1981.

U.S. Department of State, "Fishing issues: Prospector I and Quita Sueño," message number 112142, April 10, 1985;

U.S. Embassy, Bogota. Various messages: November 17, 1975; September 6, 1983; April 24; 1989, March 2, 1990; March 21, 1991; March 13, 1992; and April 11 and June 29, 1995.

U.S. Embassy, Kingston. October 16, 1981.

U.S. Embassy, Panama. November 23, 1976.

U.S. Embassy, Quito. August 26, 1975.

U.S. Embassy, Tokyo. January 18, 1989.

Valverde, Juan. Biologist, VECEP, personal communications, February 24, 1997.

Weidner, Dennis. "Mexican tuna fleet expansion," *International Fishery Reports* (IFR-82/57), May 25, 1982.

_____. "New Colombian fishing port," *Internatiinal Fishery Reports* (IFR-83/126), November 9, 1983.

_____. "Venezuelan tuna industry," *International Fishery Reports* (IFR-93/17R), May 7, 1993.

Weidner, Dennis and David Hall. "Latin America," *World Fishing Fleets*, Vol. IV (NMFS:Silver Spring, Maryland, November, 1993).

Weidner, Dennis, Tom Revord, Randy Wells, and Amir Manuar. "Latin America," *World Shrimp Culture*, Volume 2, part 3, (NMFS: Silver Spring, Maryland, 1992), pp. 779-880.

World Fishing, various issues.

Zapata Navarro, Bernardo. Experto Pesquero, GTZ-COPESNAR, personal communications, June 18 and August 4, 1997.

ENDNOTES

SECTION I (INDUSTRY OVERVIEW)

1. Amparo Alzate Medina, *Industrialización Pesquera en Colombia: Desarrollo y Perspectivas* (Medellín: Hollasa, 1988), p. 17.

2. "Anzuelo para 120,000 pequeños pescadores," *El Tiempo*, July 1, 1989.

3. For details see Dennis Weidner, Tom Revord, Randy Wells, "Latin America," *World Shrimp Culture*, Volume 2, part 3, (NMFS: Silver Spring, Maryland, 1992), pp. 779-880.

4. Alejandro Londoño García, INPA Director, personal communications, August 31, 1994.

5. Armando Hernández Rodríguez, "Dinámica del sector pesquero en los años 90," *ANDI*, March-April, 1995, pp. 67-83.

6. Hernández Rodríguez, "Dinámica del sector ...," *op. cit.*

7. Jack Beaudoin, "Latin America: Colombia," *Seafood Business*, March/April, 1997, p. 32.

8. The primary exceptions are shrimp and tuna caught by purse seiners for canning.

9. A good recent overview of Colombian fishery developments is available in Peggy Parker, "South America looks to the future," *Seafood Business*, November/December, 1995, pp. 16,18.

10. Armando Hernández Rodríguez, Executive Director, Cámara Nacional de la Industria Pesquera, personal communications, October 7, 1994.

11. Martha Lucia De la Pava, INPESCA, personal communications, April 11, 1995.

12. Colombia's primary ports have historically been the Caribbean ports. During the colonial period, legal trade was exclusively with Spain. Trade ties with other countries as well as other Spanish colonies were prohibited. The legal trade with Spain was conducted through the Caribbean ports. After independence trade was primarily with Europe. Toward the end of the 19th Century trade with the United States increased in importance. Until the Panama Canal was completed in, almost all of Colombia's trade with Europe and most of the trade with the United States was conducted through Caribbean ports and the Pacific ports were of little importance. Only in recent years have the Pacific ports grown importance as significant trade ties have been opened with Japan and several rapidly growing Asian countries, especially China and the Asian tigers.

13. Two such areas may be a Pacific (north of Buenaventura to Panama) and Caribbean (southwest of Santa Marta) area. One observer believes there may be some swordfish off the Guajira Peninsula and along the coast to Santa Marta because of the high productivity of the area. He stresses, however, that exploratory fishing is needed to confirm actual abundance. Freddy Arocha, Universidad de Oriente, personal communications, July 8, 1997.

SECTION II (SPECIES)

14. Fernando Rey, Subdirector General, Desarrollo y Ordanamiento Pesquero, Instituto Nacional de Pesca y

Acuicultura (INPA), personal commuication, March 12, 1997.

15. Luis Manjarres, INPA/VECEP, personal communications, April 17, 1997. Manjarres informs the authors that his staff (Juan Camilo Arévalo, Janeth Rodríguez, and Mónica Barros) all collaborated in supplying a detailed assessment of Caribbean fishing operations.

16. Swordfish do not school like many billfish. This non-aggregating behavior means that incidental catches by purse seiners and shrimp trawlers are likely to be very limited. Colombian waters are heavily fished by tuna purse seiners. Available assessments of the by-catch reported by purse seiners, however, confirm that swordfish incidental catches are very limited. One assessment indicates that purse seiners frequently report small billfish catches, but rarely swordfish. The amount of by-catch was significantly affected by fishing strategy. When setting on dolphin, only about 3-5 billfish were taken per 1,000 short tons (909 metric t) of tuna. School and log sets, however, resulted in much higher incidental takes, 12-94 billfish per 1,000 short tons. Martín A. Hall, "On bycatches," *Reviews in Fish Biology and Fisheries*, Vol. 6, 1996, pp. 319-352, p. 335 and Martín Hall, "An ecological view of the tuna-dolphin problem: Impacts and trade-offs," draft report, March 1997, tables 3-5.

17. Manjarres, *op. cit.*, April 17, 1997.

18. One Venezuelan specialist stresses that Atlantic fisheries at similar latitudes involve sets at depths of 70 m or more. Arocha, *op. cit.*, July 1, 1997.

19. Oscar Sosa-Nishizaki and Makato Shimizu, "Spatial and temporal CPUE trends and stock unit inferred from them for the Pacific swordfish caught by the Japanese tuna longline fishery," *Bull. Nat. Res. Far Seas Fish.*, No. 28, March, 1991, pp. 80-85 and Hideki Nakano, "Stock status of swordfish in the Pacific Ocean inferred from standardized CPUE of the Japanese longline fishery using general linear models," figure 2, in press, 1977.

20. Fabio Carocci and Jacek Majkowski, *Pacific Tunas and Billfishes: Atlas of Commercial Catches* (FAO: Rome, 1996), map 13.

21. For details see the Japanese chart reproduced in ICCAT, *Report on the Biennial Period, 1994-95* Part I (1994), Vol. 2 (ICCAT: Madrid, 1995), p. 225.

22. For background on flag of convenience registrations see G.S. Egiyan, "'Flag of convenience' or 'open registration' of ships," *Marine Policy*, March 1990, pp. 106-111.

23. Roberto Osbina, , Owner, Pescaderia Asturiana, personal communications, March 24, 1997.

24. While Colombian regulations require Colombian crews, the foreign fishermen report difficulties recruiting crews locally. Cultural and linguistic differences are probably a major problem, especially on the Asian vessels. Other problems which reportedly discourage the Colombians from working on the foreign vessels are: lengthy trips, unfamiliar food, working conditions, and others. Javier Betancourt, Manager, INPESCA, personal communications, February 20, 1997.

25. R. Osbina, *op. cit.*, March 24, 1997.

26. ICCAT, "1994 SWO background document: Figures," *Collective Volume of Scientific Papers*, XLIV (3) (ICCAT: Madrid, 1995), p. 91.

27. Rey, *op. cit.*. March 12, 1997.

28. The authors have received widely varying estimates on the Venezuelan swordfish catch. See the Venezuelan chapter of this report for details.

29. For details see the Venezuelan chapter of this report.

30. Arocha, *op. cit.*, February 4, 1997. For more details see the Venezuelan chapter of this report.

31. Venezuelan fishermen reportedly avoid the extreme western coast because of possible conflicts with Colombian authorities if they cross the undelimited marine boundary. The Venezuelan EEZ in particular is quite narrow between Colombia and Aruba. It has traditionally been a high tension area between the two countries. It is also potentially dangerous because of drug smuggling activity. (See "Enforcement".) Many fishermen recount stories of vessels disappearing and, as a result, reportedly avoid the area. Arocha, *op. cit.*, July 8, 1997.

32. For details see the Panamanian chapter of this report.

33. One observer stresses that the lack of Ecuadorean effort for swordfish east of the Galápagos does not necessarily mean that species is not present. Arocha, *op. cit.*, July 8, 1997.

34. Boris Buenaventura, Executive Director, Asociación de Exportadores de Pescado Blanco (Ecuador), May 15, 1996 and March 21, 1997.

35. Mario Cobo Cedeño, Director General, Instituto Nacional de Pesca, personal communications, March 26, 1997. For details on the country's developing swordfish fishery see the Ecuadorean chapter of this report. The authors are unable to confirm such a large Ecuadorean catch. Available reports from individual fishing companies as well as import data from major consuming countries suggest that catches of about 200 t through 1996 were more likely.

36. Most of the swordfish catch is exported, thus sharp increases in catches are usually reflected in corresponding export increases. Foreign 1995 swordfish import shipments from Ecuador, however, do not confirm such a large catch increase (Ecuador, appendix D5a).

37. For details see the Chilean and Peruvian chapters of this report.

38. S. Kip Farrington, Jr., *Fishing the Pacific: Offshore and On* (New York: Coward-McCann, 1953).

39. Fisheries in temperate waters (Canada, Chile, Japan, Peru, and the United States) have been conducted with harpoons. Such fishing was possible as the fish basked at the surface in the warm morning sun after feeding in cold deep water. For details see the Chilean and Peruvian chapters of this report. This is not the case in the tropical waters off Venezuela and Colombia. Arocha, *op. cit.*, July 8, 1997.

40. One Venezuelan specialist emphasizes, however, that most of the billfish by-catch appears in tuna targeted fisheries, primarily those targeting yellowfin and little swordfish is taken in those fisheries. Most of the swordfish by-catch is taken in tuna fisheries targeting bigeye and to a lesser extent albacore. Arocha, *op. cit.*, July 1, 1997.

41. See each of these individual country chapters for details.

42. The swordfish results reported by foreign longline fishermen are discussed in detail under "Stock structure" below. For a good assessment of foreign tuna longline fisheries in the ETP see Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, maps 1-7.

43. Arocha, *op. cit.*, July 1, 1997.

44. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, maps 1-4.

45. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, maps 10-11. Stripped marlins appears to have been much more prevalent during the 1960s-70s. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, maps 8-9.

46. Y. Uozumi, "Preliminary analysis on the distribution of sailfish and longbill spearfish in the Atlantic Ocean in 1993 based on the logbook data," *ICCAT Collective Volume of Scientific Papers*, XLIV (3), SCRS/94/156 (ICCAT: Madrid, Spain, 1995), pp 26-29.

47. Luis Alonzo Padilla, Coordinator of Marine Resource Evaluation, INPA/VECEP, personal communications, February 28, 1997.

48. Manjarres, *op. cit.*, February 24, 1997.

49. Arocha, *op.cit.*, July 1, 1997.

50. Proyecto de Pesca Marítima INDERENA-FAO as cited in INDERENA, *Bases Para un Plan de Desarrollo del Subsector Pesquero Colombiano*, undated but probably 1978, p. 36.

51. Arocha, *op. cit.*, July 1, 1997.

52. See the Latin American overview of this report for a review of theories on the stock structure of Pacific swordfish.

53. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, maps 9-11. This concentration did not show in the data presented for 1962-64 (map 8). The authors of this study have decided to exclude the 1962-64 data, because foreign fishing had not yet approached the southern Peruvian or the Chilean coast and thus did not cover an important section of the southeastern Pacific. In addition, swordfish catches in many oceanic areas of the southeastern Pacific during 1962-64 were much lower than during what the authors believe are the more representative years presented for the 1970s, 80s, and 90s (maps 9-11). The Carocci and Majkowski study did not include swordfish taken by Peruvian and Chilean fishermen, which in some years was substantial. Chilean artisanal and commercial fishermen during the early 1990s, for example, landed very substantial quantities of swordfish. See the Chilean and Peruvian chapters of this report for details. Carocci and Majowski are planning a future edition of their atlas with additional data from artisanal fisheries, or in the case of Chile with data from both artisanal and commercial fisheries. Jacek Majkowski, Department of Fisheries, FAO, personal communications, April 7, 1997.

54. See figure 1 displaying the geographic distribution of swordfish catches in Yuji Uozumi and Kotaro Yokawa, "Country report for the swordfish fisheries in the Pacific Ocean," paper delivered at the Second International Swordfish Symposium, March 3, 1997, Turtle Bay, Oahu, Hawaii, p. 6.

55. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

56. Some catches are occasionally noted as far north as Central America. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85; Uozumi and Yokawa, "Country report ...," *op. cit.*, p. 6.; and Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

57. Currently most of the South American catch of swordfish is taken off Chile. The Chilean fishery appears to follow the migratory movement of the fish along the coast, although fishermen in recent years have been increasingly fishing at greater distances from the coast. For details see the Chilean chapter of this report. The fishing pattern reported by the Chilean fishermen, combined with the available Japanese longline data in oceanic areas, form a distinct cluster in the southeastern Pacific, suggesting a possible separate southeastern Pacific population.

58. Interestingly, available Japanese data suggest differing seasonal patterns. Available historic yield data (1952-85) show the best results off Colombia, especially along the coast, during the first half of the year (appendix B2b). Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85. Recent catch data (1991-93), however, show better results off Colombia on offshore grounds during the second half of the year. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13. In both data sets, however, there are significant seasonal differences between the peak appearance of swordfish in the waters off Colombia and off

Ecuador/northern Peru to the south.

59. Carol Reeb and Barbara Block, "Genetic analysis of Pacific swordfish populations using mtDNA and microsatellite markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

60. Naritoshi Cho, "An attempt to clarify genetic stock structure of swordfish using nuclear gene markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

61. Reeb and Block, "Genetic analysis ...," *op. cit.*

62. Oceanographers are increasingly using the term "Chile" or "Peru" Current instead of the "Humboldt" Current. As this study describes the swordfish fishery off Chile, Peru, Ecuador, and Colombia, the authors concluded that referring to the term Chile or Peru Current might be confusing. In addition, in deference to the many Chilean and Peruvian experts who assisted in this project, the authors did not want to select either the "Chile" or "Peru" Current until researchers in those countries reach agreement among themselves as to the proper nomenclature.

63. Julie M. Porter, "Perspective on Atlantic (and Mediterranean) swordfish fisheries and assessments: The ICCAT experience," paper delivered at the Second International Swordfish Symposium, March 3, 1997, Turtle Bay, Oahu, Hawaii.

64. For details see the Venezuelan chapter of this report.

65. The NMFS Honolulu Laboratory in 1997 is assessing Hawaii longline data and environmental data to determine seasonal large-scale, regional, and local horizontal movement patterns of swordfish.

66. Various authors have described the relationship of swordfish along the US Atlantic coast with the Gulf Stream. Guillermo Podesta, "Aspects of swordfish oceanography in the Atlantic," and Jean Cramer and Don Kobayahi, "The effect of environmental variation on the density of swordfish discarded by U.S. longline fishermen, "Second International Pacific Symposium," Turtle Bay, Hawaii, May 4 and 5, 1997. See the Chilean chapter of this report for details on the migratory track of swordfish off Chile and the Humboldt Current.

67. Arocha, *op. cit.,* July 1 and 8, 1997.

68. The most extensive data base is the Japanese longline data, but as the primary target species was tuna, the swordfish fluctuations could represent variations on effort directed at the target species. In addition, one of the more helpful resources was the recently published FAO atlas (Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*), however, there are some serious flaws in the handling of the data which need to be corrected in future additions.

69. Immediately west of Colombia there are great differences noted in the 5° square statistical reporting blocks. Further west there appears somewhat more uniformity over wider areas. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

70. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

71. Uozumi and Yokawa, "Country report ...," *op. cit.*, p. 6 and Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

72. Reeb and Block, "Genetic analysis," *op. cit.*

73. Uozumi and Yokawa, "Country report ...," *op. cit.*; Nakano, "Stock status of swordfish ...," *op. cit.*; and Sosa-Nishizaki, "Spatial and temporal CPUE ..., *op. cit.* There are, however, areas along the Central American coast, especially off Nicaragua, El Salvador, and Guatemala), where swordfish are more abundant (appendix B2b). Sosa-Nishizaki, "Spatial and temporal CPUE ..., *op. cit.* See also the Central American chapters of this report.

74. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

75. Sosa-Nishizaki, "Spatial and temporal CPUE ..., *op. cit.*, p. 85.

76. The most comprehensive Pacific study of oceanic fish larvae has been conducted by the Japanese National Research Institute of Far Seas Fisheries (NRIFSF). Researchers with the NRIFSF failed to find any swordfish larvae east of 108°W, although they did not test waters south of 12°S. Nisikawa, Honma, Yueyanagi, and Kikawa, *Average Distribution of Larval Oceanic Species of Scombroid Fishes, 1956-81* (Far Seas Fisheries Research Laboratory: Shimizu, Japan, 1985), Series S No. 12. Other larval studies have included: CALCOFI, EASTROPAC I and II, and the Soviets R/V *Akademik Kurchatov* (cruise 17). They have all failed to find swordfish larvae east of 108°W. While these surveys were not designed specifically for swordfish, they did encounter larvae of similar species (such as frigate mackerel and sailfish). If swordfish larvae had been present, researchers would have presumably also have encountered it. Larvae of several other oceanic species such as bigeye and yellowfin tuna were also absent or extremely rare. Researchers are unsure as to why spawning of these oceanic species does not appear to be taking place in the ETP--despite appropriate temperatures and salinities. Robert Humphreys, "Review of larvae and juvenile distributions with inference towards spawning habitat," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

77. Rey, *op. cit.*, April 8, 1997.

78. For details see the individual country chapters, especially Ecuador, Peru, and Chile. U.S. researchers have also not found swordfish in plankton studies along the coast of California, Oregon, and Washington. The absence of swordfish in the extensive CALCOFI plankton record is especially notable.

79. For details see the Ecuadorean chapter of this study.

80. Sosa-Nishizaki, "Spatial and temporal CPUE ..., *op. cit.*, pp. 80-85.

81. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

82. Few Central American countries have domestic longline fleets. (The Honduran and Panamanian-flag longline fleets are mostly flag-of-convenience vessels which do not operate extensively off the Central American coast.) The only Central American country with a significant longline fishery is Costa Rica. The Costa Rican fishery is relatively new and has targeted tunas--reporting only small swordfish catches. The authors note, substantially increased U.S. swordfish imports from Costa Rica in 1996. For details see the Costa Rican chapter of this report.

83. The limited catches could in part be due to the lack of effort. For details see the Costa Rican and other Central American chapters of this report. Japanese fishermen have at times reported some good catches off northern Central America (appendix B2b).

84. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

85. Carocci and Majkowski, *Pacific Tunas and Billfishes*, *op. cit.*, map 13.

86. Sosa-Nishizaki, "Spatial and temporal CPUE ..., *op. cit.*, pp. 80-85.

87. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

88. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

89. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13. Further south off southern Peru and Chile, however, the data suggests a very strong seasonal migratory pattern. For details see the Chilean chapter of this report.

90. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

91. Nakano, "Stock status of swordfish ...," *op. cit.*, fig. 8.

92. See the Chilean chapter of this report for details.

93. ICCAT, *Report for the Biennial Period, 1994-95*, Part II (1995), Vol. 2 (ICCAT: Madrid, 1996), pp. 63-65.

94. The most significant factor is probably the less intense coastal upwelling. One observer cautions, however, that warmer water does not necessarily mean lower productivity of prey species as the swordfish may adjust to species available. Christofer Boggs, NMFS Honolulu Laboratory, personal communications July 8, 1997.

SECTION III. (FISHING GROUNDS)

95. Matthias Tomczak and J. Stuart Godfrey, *Regional Oceanography: An Introduction* (Pergamon: London, 1994), p. 144.

96. Tomczak and Godfrey, *Regional Oceanography*, *op. cit.*, pp. 119 and 126.

97. Tomczak and Godfrey, *Regional Oceanography*, *op. cit.*, pp. 119, 126-127.

98. Nakamura, "Billfishes of the World," *op. cit.*, p. 49.

99. Arocha, *op. cit.*, July 1, 1997.

100. This is roughly the range for the Chilean fishery. The artisanal fishery focuses on IFOP zones 3, 4, and 6 (28-42°S) where the highest yields and most of the catch is generally taken. (Chile, appendix C2d-e and E2h1-2). The commercial fishery, which in some years lands most of the catch, primarily operates to the north in zones 1 and 3 (18-35°S) (Chile, C3c-d and E2h1-2).

101. J.M. Tobella, "La pesquería de pez espada (*Xiphias gladius*) en Chile," Tesis, Esc. Cs. del Mar, Universidad Católica de Valparaíso, 1964, 89p. and G.M. Tobella,"Observaciones y conclusiones de la temporada de pesca de pez espada de 1967," Tesis, Esc. Cs. del Mar, Universidad Católica de Valparaíso, 1970, 74p. as cited in Barbieri, *et. al.*, "La pesquería de pez espada ...," *op. cit.*, p. 196. For additional details see the Chilean chapter of this report.

102. One swordfish expert cautions that he believes that the best explanation is probably that swordfish are not being targeted with sufficiently deep sets or with the proper bait and/or fishing strategy. Arocha, *op. cit.*, July 1, 1997.

103. The Japanese catches in the southeastern Pacific are primarily taken in oceanic waters. While conducted at tropical latitudes, it is carried out in areas with current flows producing strong temperature fronts. The Japanese also conduct operations further south, but closer to the South American coast. Uozumi and Yokawa, "Country report ...," *op. cit.*, p. 6.

104. Water temperatures along the Peruvian coast, however, are not tropical as a result of the cold Humboldt Current.

105. Occasional catches are reported in waters as warm as 26-27°C. Boris Buenaventura, President, Pesymar, personal communications, March 21, 1997.

106. For details see the Ecuadorean chapter of this report.

107. Very little is known about mesopelagic fauna and ecology. Arocha, *op. cit.*, July 8, 1997.

108. Christopher Boggs and Keith Bigelow, "Progress report to Pelagic Fishery Research Program (PFRP)," June 1996, internet posting.

109. See the clustering reported by Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13; Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*; and Nakano, "Stock status of swordfish ...," fig. 2. The general location of major oceanic currents are depicted in figure 10.

110. IATTC, *Annual Report* (IATTC: La Jolla, California, 1994), pp. 95-98.

111. Tomczak and Godfrey, *Regional Oceanography*, *op. cit.*, p. 127.

112. Research underway in 1997 at the NMFS Honolulu Laboratory assessing vertical swordfish movements may provide some insights on swordfish interactions with the thermocline.

113. Arocha, *op. cit.* July 1, 1997.

114. Jack Hogan as cited in Roger Fitzgerald, "Of mercenaries and monofiliment," *Seafood Leader*, May-June, 1996, p. 69.

115. Guillermo Podesta, "Aspects of swordfish oceanography in the Atlantic," "Second International Pacific Symposium," Turtle Bay, Hawaii, March 4, 1997. The NMFS Hawaii Laboratory plans to use archival tags in 1998 to monitor horizontal and vertical movement in greater detail. Christofer Boggs, NMFS, personal communications, July 9, 1997.

116. For details see the Venezuelan chapter of this report.

117. Arocha, *op. cit.*, July 1, 1997.

118. For more details see the Venezuelan chapter of this report.

119. Nicaragua does not recognize these claims and there have been occasional incidents between the two countries, especially during the Sandinista era (1980s).

120. Tomczak and Godfrey, *Regional Oceanography, op. cit.*, p. 314.

121. IATTC, *Annual Report*, *op. cit.*, pp. 95-98. Additional information on ETP fishing grounds for tuna and billfish are available in Carocci and Majkowski, *Pacific Tunas and Billfish, op. cit.*

122. Arocha, *op. cit.*, July 7, 1997.

123. See "Fleet Operations and Gear" for more details.

124. Arocha, *op. cit.*, July 1, 1997.

125. Arocha, *op. cit.*, July 1, 1997.

126. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ..., *op. cit.*, pp. 80-85 and Uozumi and Yokawa, "Country report ...," *op. cit.*, p. 6..

127. Available data suggest that much of the fleet, other than shrimp and tuna vessels, targets demersal species (appendix A3b). The great bulk of the commercial landings, however, with the exception of the Tumaco landings, is anchoveta--a small pelagic species taken with purse seines.

128. Instituto Nacional de Pesca y Acuicultura (INPA), *Boletín Estadístico Pesquero, 1995* (INPA, Bogota, 1996).

129. Valverde, *op. cit.*, February 24, 1997 and Betancourt, *op. cit.*, February 20, 1997.

130. INPA, *Boletín Estadístico Pesquero*, 1995.

131. U.S. Embassy, Bogota, "World swordfish fisheries study: Colombian information," message number 8912, June 29, 1995.

132. Farrington, *Fishing the Pacific*, *op. cit.*

133. Yuji Uozumi and Kotaro Yokawa, "Country report for the swordfish fisheries in the Pacific Ocean," paper delivered at the Second International Swordfish Symposium, March 3, 1997, Turtle Bay, Oahu, Hawaii.

134. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 9-11.

135. Hideki Nakano, "Stock status of swordfish in the Pacific Ocean inferred from standardized CPUE of the Japanese longline fishery using general linear methods," in press as of March 1997.

136. INPA, *Boletín Estadístico Pesquero* 1995, *op. cit.*

137. INPA, *Boletín Estadístico Pesquero*, 1995, *op. cit.*

138. Manjarres, *op. cit.*, April 27, 1997.

139. INPA, *Boletín Estadístico Pesquero*, 1995, *op. cit.*

140. U.S. Embassy, Bogota, "World swordfish fisheries study: Colombian information," message number 8912, June 29, 1995 and Manjarres, *op. cit.*, April 17, 1997.

141. Manjarres, *op. cit.*, April 17, 1997.

142. One observer stresses, however, that this could be because the species is not being targeted. Manjarres, *op. cit.*, April 17, 1997.

143. Luis Manjarres Martinez and Blanca González Porto, "Evaluación de una unidad pesquera artesanal que operó con red enmalle, palangre tiburonero y lineas mano," *Proyecto Integral de Investigaciones y Desarrollo de la Pesca Artesanal Marítima en al Area de Santa Marta: Informe Técnico Final*, Componente de Recursos y Captura (INPA/CIID/UNIMAGALENA: Magdalena, Colombia, 1933), pp. 145-164.

144. INPA officials working with artisanal fishermen report that 8 t of billfish (mostly sailfish) was landed on San Andrés during 1995, but for unknown reasons it was not reported in INPA's *Boletín Estadístico Pesquero.* Manjarres, *op. cit.*, April 17, 1997.

145. INPA, *Boletín Estadístico Pesquero*, various years.

146. M. Giudicelli, "Proyecto Inter-Regional para el Desarrollo de la Pesca en el Atlántico Centro-Occidental," *Informes WECAF*, No. 15, August, 1979, p. 4.

147. INDERENA, *Bases Para un Plan ...*, *op. cit.*, p. 32.

148. U.S. Embassy, Bogota, message number 8912, June 29, 1995.

149. INPA, *Boletín Estadístico Pesquero*, *op. cit.* various years and Manjarres, *op. cit.*, April 17, 1997.

150. Japanese historical data shows extensive operations in the western Caribbean off Colombia. See Japanese charts in ICCAT, *Report for Biennial Period, 1994-95*, Part II (1995), Vol. 2 (ICCAT: Madrid, 1996), pp. 53 and 58.

151. For details see the Japanese chart reproduced in ICCAT, *Report on the Biennial Period, 1994-95* Part I (1994), Vol. 2 (ICCAT: Madrid, 1995), p. 225.

152. For details see the entries for Bahía Cupica and Pesquería Asturiana in the company chapter.

SECTION IV. (FLEET)

153. J.P. D'Alarçao, J. Puig Aleu, C. Tapias R., and H. Naranjo O, *Notas Sobre la Pesca Artesanal en Colombia* (Bogota: UNDP/INDERENA, 1969), pp. 4, 7-9.

154. INDERENA, *Bases Para un Plan ...*, *op. cit.*, p. 90.

155. M. Giudicelli, "La pesca artesanal marítima en la costa Caribeña de Colombia: Su situación, sus posibilidades y sus necesidades para el desarrollo," *Informe WECAF*, No. 8, August, 1979, pp. 9-25.

156. Presidencia de la República, Consejero Nacional de Pesca, *Programa PROPESCA*, May, 1986, p. 85-A.

157. Juan Valverde, Biologist, VECEP, personal communications, February 24, 1997. For details see the Ecuadorean chapter of this report.

158. Luis Manjarres, INPA/VECEP, Santa Marta, personal communications, February 24, 1997.

159. Manjarres, *op. cit.*, April 17, 1997.

160. Manjarres, *op. cit.*, February 24, 1997.

161. The fishermen reportedly encountered schools of 10-20 billfish. The results, however, were not sufficiently successful to counter years of tradition in deploying bottom longlines. Manjarres, *op. cit.*, February 24 and April 17, 1997.

162. Padilla, *op. cit.*, February 28, 1997.

163. Padilla, *op. cit.*, February 28, 1997.

164. Betancourt, *op. cit.*, February 20, 1997.

165. Valverde, *op. cit.*, February 24, 1997.

166. Padilla, *op. cit.*, February 28, 1997.

167. Alvaro Robayo, MARCOL, personal communications, March 5, 1997.

168. The authors are unable to explain the discrepancies between the INPA data in appendices A3b and A5a.

169. Hall, "On bycatches," *op. cit.*

170. Bernardo Erazo, Production Manager, C.I. Océanos, personal communications, April 21, 1997.

171. Rey, *op. cit.*, March 11, 1996.

172. Hortencia Hernández, Export Manager, FRIGOGAN, personal communications, February 19, 1997.

173. Hall, "On bycatches," *op. cit.*

174. U.S. Embassy, Bogota, "World swordfish fisheries study: Colombian information," message number 8912, June, 29, 1995.

175. Marta Lucia De la Pava, Manager, Bahía Cupica, personal communications, February 26, 1997 and Roberto Osbina, Owner, Pescaderia Asturiana, personal communications, March 24, 1997.

176. The authors have no information on Chinese longliners working off Latin America. Usually reported Chinese vessels are Taiwan vessels. Some Latin American sources mistakenly refer to Taiwan vessels and fishermen as Chinese. Taiwan has a much larger fleet of longliners than China, but does deploy a few vessels in distant waters so the vessels could in fact be Chinese. Colombia recognizes China and thus would not approve vessel leasing arrangements with Taiwan-flagged vessels. For this and other reasons many Taiwan vessels are registered under flag-of-convenience flags. Weidner and Hall, "Latin America," *op. cit.*, p. 26. In some instances Taiwan owned vessels have been flagged in China and use Chinese crews.

177. De la Pava, *op. cit.*, February 26, 1997.

178. R. Osbina, *op. cit.*, March 24, 1997.

179. For details on the overall licensing program see Weidner and Hall, "Latin America," *op. cit.*, pp. 345-347.

180. For details see Weidner and Hall, "Latin America," *op. cit.*, pp. 20-27. For general background on flag-of-convenience registrations see G. S. Egiyan, "'Flag of convenience' or 'open registration' of ships," *Marine Policy*, March 1990, pp. 106-111.

181. Weidner and Hall, "Latin America," *op. cit.*, p. 171.

182. As mentioned above, it is unusual for Chinese longliners to be deployed off Latin America. The vessels may be Taiwan-owned. For details on such flag-of-convenience registrations see Weidner and Hall, "Latin America," *op. cit.*, pp. 20-27.

183. Weidner and Hall, "Latin America," *op. cit.*, pp. 183-192.

184. Dennis Weidner, "Mexican tuna fleet expansion," *International Fishery Reports* (IFR-82/57), May 25, 1982.

185. R. Osbina, *op. cit.*, March 24, 1997.

186. See the U.S. chapter of this report for details.

187. Dennis Weidner, "Venezuelan tuna industry," *International Fishery Reports* (IFR-93/17R), May 7, 1993.

188. For details see the Venezuelan chapter of this report.

SECTION V. (SHIPYARDS)

189. Nippon Kokan and Marubeni in 1974 acquired a 20-percent equity share in CONASTIL. "Shipbuilding project in Colombia," KYODO, 1027 GMT, June 17, 1974.

190. Roberto Spicker Guzman, Gerente Commercial, Compañía Colombiana de Astilleros, personal communications, August 9, 1993.

191. U.S. Embassy, Bogotá, July 7, 1993.

192. Isaac Muñoz, Gerente de Construcción, Industria Naval del Pacífico, personal communications, July 1, 1993.

193. Ley 13, Estatuto General de Pesca (1990), especially Article 67, and implementing regulations, Decree 2256 of 1991, Article 156. U.S. Embassy, Bogotá, July 8, 1993.

SECTION VI. (VESSEL SOURCES)

194. Hall, "On bycatches," *op. cit.*, p. 335 and Hall, "An ecological view ...," *op. cit.*, tables 3-5.

195. INPA defines artisanal fishing vessels as up to 15 m in length, 3 m in width, 5 NRT, and motors of 150 hp (inboard or 200 hp (outboard). Vessels over these limits are classified as commercial. Resolución 383, July 2, 1996.

196. D'Alarçao *et. al.*, *Notas ... op. cit.*, pp. 4-5, 7-9. A more recent description of the inshore artisanal fishery is available in Jorge Gallo Nieto, "Análisis preliminar de los artes y métodos de pesca en la cienaga grande de Santa Marta con énfasis en el método del bolichero," *Trianea* Vol. 1, 1988, pp. 229-242. An excellent description of the various gears is available in Inderena, *Bases Para un Plan ...*, *op. cit.*, p. 91-98.

197. Giudicelli, La pesca artesanal ...," *op. cit.*, p. 10-25.

198. D'Alarçao *et. al.*, *Notas ... op. cit.*, pp. 4-5, 7-9. and Giudicelli, "La pesca artesanal, *op. cit.*, pp. 11-12. A more recent description of the inshore artisanal fishery is available in Jorge Gallo Nieto, "Análisis preliminar de los artes y métodos de pesca en la cienaga grande de Santa Marta con énfasis en el método del bolichero," *Trianea* Vol. 1, 1988, pp. 229-242.

199. Fishery resources off the Guajira are more abundant and there are fewer alternative economic opportunities than around the larger cities like Cartagena to the south. Giudicelli, "La pesca artesanal ...," *op. cit.*

200. Giudicelli, "La pesca artisanal ...," *op. cit.*, p. 1.

201. Giudicelli, "La pesca artisanal ...," *op. cit.*, p. 7.

202. Robayo, *op. cit.*, March 5, 1997.

203. One of the few studies known to the authors describing artisanal longlining, along with other methods, is a now dated report, Génesis Guerrero O., "Desarrollo técnicas y producción pesquera de Taganda, Santa Marta, 1978," (INVEMAR: Santa Marta, 1980), 260p. An informative, but now dated overview of the artisanal fishery is P.A. Arias and E. Escobar, *La Pesca Artesanal en Colombia* (Bogota: INDERENA, 1989), 62p.

204. Luis Manjarres Martinez and Blanca Gonzalez Porto, "Evaluación de una unidad pesquera artesanal que operó con red de enmalle, palangre tiburonero y lineas de mano," *Proyecto Integral de Investigaciones y Desarrollo de la Pesca Artesanal Marítima en el Area de Santa Marta: Informe Técnico Final* (Magdalena, Colombia: INPA/CIID/Unimagdalena, 1993), pp. 145-161.

205. Betancourt, *op. cit.*, February 20, 1997.

206. Padilla, *op. cit.*, February 28, 1997.

207. Martínez and González, "Evaluación de una unidad pesquera artesanal ...," *op. cit.*, p. 146.

208. Manjarres, *op. cit.*, February 24, 1997.

209. INDERENA, *Bases Para un Plan ...*, *op. cit.*, p. 90.

210. Rey, *op. cit.*, March 12, 1997.

211. For details, see the Ecuadorean chapter of this report.

212. Valverde, *op. cit.*, February 24, 1997.

213. Valverde, *op. cit.*, February 24, 1997.

214. Betancourt, *op. cit.*, February 20, 1997.

215. Manjarres Martinez and Gonzalez Porto, "Evaluación de una unidad pesquera artesanal ...," *op. cit.*, pp. 145-161.

216. Juan Asís, boat captain, personal communications, February 24, 1997.

217. Asís, *op. cit.*, February 24, 1997.

218. Luis Manjarres Martinez and Blanca Gonzalez Porto, "Evaluación de una unidad pesquera artesanal que operó con red de enmalle, palangre tiburonero y lineas de mano," *Proyecto Integral de Investigaciones y Desarrollo de la Pesca Artesanal Maritima en el Area de Santa Marta: Informe Técnico Final* (Magdalena, Colombia: INPA/CIID/Unimagdalena, 1993), pp. 145-161.

219. Asís, *op. cit.*, February 24, 1997.

220. Hall, "On bycatches," *op. cit.*

221. Farrington, *Fishing the Pacific*, *op. cit.*

222. U.S. Embassy, Bogota, "Billfish regulations," message number 11629, December 15, 1977.

223. Valverde, *op. cit.*, February 24. 1997 and Padilla, *op. cit.*, February 28, 1997.

224. Manjarres, *op. cit.*, February 24, 1997; Reyes, *op. cit.*, March 12, 1997; and Ricardo Alvarez-León, Projecto Manglares de Colombia, Ministerio de Medio Ambiente, personal communications, August 10, 1997.

225. H. Hernández, *op. cit.*, February 19, 1997.

226. Hall, "On bycatches," *op. cit.*

227. Basic information on the high-seas fleet operations are available in the Japanese chapter of this study. Wildman, "Asia," *op. cit.*

228. Bernardo Erazo, Production Manager, C.I. Océanos, personal communications, April 21, 1997.

229. A. Osbina, *op. cit.*, March 20, 1997.

230. R. Osbina, *op. cit.*, March 24, 1997.

231. Marta Lucia de la Pava, Manager, Bahia Cupica, personal communications, February 26, 1997.

232. Decree 2324 of 1984 and Law 13 of 1990 and its implementing Decree 2256 of 1991 establish the conditions for operation of national and foreign crews that fish in territorial, adjacent international, and international waters. U.S. Embassy, Bogota, message number 012998, 1991.

233. Betancourt, *op. cit.*, February 20, 1997.

234. De la Pava, *op. cit.*, February 26, 1997.

SECTION VIII. (CATCH)

235. The 22-23 person crew consisted of: Colombians (5), Japanese 8-9), and Indonesians (9-10). R. Osbina, *op. cit.*, March 24, 1997.

236. The contracts with the Japanese companies are signed official contracts. INPA prepared a standard, official contract form to be completed by both parties. These contracts are presented to INPA and Dirección Marítima (DIMAR) which supervises the Capitanía de Puertos. Erazo, *op. cit.*, April 21, 1997.

237. U.S. Embassy, Bogota, "World swordfish fisheries study: Colombian information," message number 8912, June 29, 1995.

238. De la Pava, *op. cit.*, February 26, 1997 and R. Osbina, *op. cit.*, March 24, 1997.

239. De la Pava, *op. cit.*, February 26, 1997.

SECTION VII. (FLEET OPERATIONS AND GEAR)

240. Hernández, *op. cit.*, March 10, 1997.

241. U.S. Embassy, Bogota, message number 8912, June 29, 1995.

242. Rey, *op. cit.*, Match 8, 1996.

243. Rey, *op. cit.*, March 12, 1997.

244. Trends in other oceanic pelagic fisheries are useful because of possible swordfish by-catches (or lack of such by-catches). In addition, fishermen targeting other oceanic pelagics may have the skill to eventually target swordfish if the species was available in commercial quantities.

SECTION VIII. (PORTS)

245. Betancourt, *op. cit.*, February 20, 1997.

246. Rey, *op. cit.*, March 11, 1996.

247. Rey, *op. cit.*, March 11, 1996.

248. "Colombia to build new fishing port," *Eurofish Report*, July 21, 1988.

249. "Buenaventura--Hub of Pacific coastal region, "*Colombia Today*, Vol. 22, No. 1, 1987, p. 2.

250. Dennis Weidner, "New Colombian fishing port," *International Fishery Reports* (IFR-83/126), November 9, 1983, and U.S. Embassy, Bogota, "Early warning-major project: Buenaventura fish processing facilities and fishing port," message number 13373, September 1, 1989.

251. "Colombian port plan," *Fishing News International*, June, 1989, p. 24.

252. Edmer Tovar M., "Buenaventura entró en la area del atún," *El Tiempo*, January 24, 1989.

253. Betancourt, *op. cit.*, February 20, 1997.

254. U.S. Embassy, Bogota, "Buenaventura looks ahead," message number 4450, March 21, 1991.

255. Rolf Juhl, NMFS memorandum, December 2, 1981.

256. "Con $300 millones se construye centro de servicios al pescador," *El Universal*, June 22, 1988.

SECTION IX (TRANSSHIPMENTS)

257. Alejandro Moya, "Redención de la Costa Pacífica," *El Tiempo*, July 7, 1987.

SECTION X. (TRANSSHIPMENTS)

258. "Colombie: Construction d'une usine de transformation du poisson," *La Pêche Maritime*, April, 1989, p. 247.

259. Betancourt, *op. cit.*, February 20, 1997.

260. Robayo, *op. cit.*, March 5, 1997.

261. Bernardo Zapata Navarro, Experto Pesquero, GTZ-COPESNAR, personal communications, June 18, 1997.

SECTION IX. (TRANSSHIPMENTS)

262. Estatuto General de Pesca, Ley 13, January 15, 1990, Article 31.

263. In particular see the chapters on Japan, Korea, and Taiwan in the Asian volume. Wildman, "Asia," *op. cit.*

264. The small number of Japanese longliners operating under Colombian licenses are required by Colombian law to transship through Colombian ports. There is of course always the possibility of even these vessels transshipping at sea. At least some of the crew is Colombian. Several of the Japanese vessels have worked with the same Colombian company for a number of years. It would thus be difficult for the Japanese companies involved to transship sizeable quantities at sea in violation of Colombian law over any extended period.

265. "Illegal Japanese tuna fishing off South America," *Kyodo*, April 11, 1994.

266. De la Pava, *op. cit.*, February 26, 1997. It is unclear to the authors why such small quantities of swordfish are landed. Operations in Colombian waters may yield only occasional swordfish. The associated vessels, however, also operate on the highseas. One would assume that some of these highseas operations would yield more than an occasional swordfish. One possibility as mentioned above is illegally transshipping some of the catch at sea. The Japanese have a fleet of refrigerated tenders which service the highseas tuna fleet. It would be difficult, however, for the Japanese fishermen to conduct such illegal operations successfully over an extended period.

267. De la Pava, *op. cit.*, February 26, 1997.

268. Roberto Osbina, owner, Pesquera Asturiana, personal communications, March 21, 1997.

269. De la Pava, *op. cit.*, February 26, 1997.

SECTION X. (PROCESSING AND PRODUCTS)

270. Rey, *op. cit.*, March 11, 1996.

271. "Yellowfin shortage," *GLOBEFISH Highlights*, 4/94, pp. 11-12.

272. Rey, *op. cit.*, March 11, 1996.

273. De la Pava, *op. cit.*, February 26, 1997.

274. Padilla, *op. cit.*, February 28, 1997.

275. A. Osbina, *op. cit.*, Match 20, 1997.

SECTION XI. (COMPANIES)

276. Armando Hernández, Executive Director, Cámara de la Industria Pesquera, personal communications, March 10, 1997.

277. For details on the companies involved see Weidner, Revord, Wells, and Manuar, *World Shrimp Culture*, *op. cit.*, pp. 779-880.

278. Representatives of Colombian companies insist that the billfish taken incidentally by the shark fishermen is marketed domestically. (See "Markets".) Given the quality standards of the shark fishermen, this is almost certainly the case. The companies with the foreign tuna longliners report that the by-catch, including billfish, is also marketed domestically. The origin of the exports to Japan is thus unexplained. The authors believe, however, that given the technical demands of the fishery and the quality requirements of the Japanese market, the exports probably were supplied by foreign vessels.

279. De la Pava, *op. cit.*, February 26, 1997 and R. Osbina, *op. cit.*, March 24, 1997.

280. Jaime Bravo Lozano, Manager, ARPECOL, personal communications, February 19, 1997.

281. Diego Canelos, Manager, Atunes de Colombia, personal communications, March 10, 1997.

282. The Colombians refer to "pesca blanca" meaning a variety of species with light-colored flesh. The literal translation is "white fish," but in English this suggests exclusively demersal species like cod and hake with white flesh. The Colombians and many other Latin Americans use it to mean a wide range of popular edible species, including pelagic species such as tuna, billfish, dorado, and shark.

283. It is unclear to the authors why Bahia Cupica is not on INPA's list of companies working with licensed foreign tuna vessels in 1995 (appendix A5c). The *Chiyoda Maru 11* was listed as working with INPESCA in 1995, but the other two longliners were not listed as licensed vessels in 1995 (appendix A5a). These listings did appear in INPA's 1996 license list along with two other vessels, the *Cocoliso* and *Patricia Lynn* (appendix A6d), presumably not longliners.

284. De la Pava, *op. cit.*, February 26, 1997.

285. Antonio Chalela Martínez, Gerente General, COAPESCA, personal communications, February 27, 1997.

286. Chalela Martínez, *op. cit.*, June 12, 1997.

287. Tovar, " Buenaventura entró ...," *op. cit.*

288. Jaiduberto Umaña, Administrator, COPESCOL, personal communications, February 19, 1997.

289. Zapata Navarro, *op. cit.*, June 18, 1997.

290. Zapata Navarro, *op. cit.*, August 4, 1997.

291. Hortencia Hernández, Export Manager, FRIGOGAN, personal communications, February 19, 1997.

292. The authors have made repeated attempts to contact this company, but no one answers the phone.

293. Augusto Mainero Román, President, Frigopesca, personal communications, January 18, 1995.

294. INFOPESCA "Convenio pesquero para procesamiento de atún," *Notas Comerciales*, February 20, 1989.

295. FRIGOPESCA, "Programa de inducción para aspirantes a operarias 'proceso lomo de atún'," Cartagena, February, 1994.

296. See Pescaderia Asturiana for details on the arrangements.

297. Betancourt, *op. cit.*, February 20, 1997.

298. Betancourt, *op. cit.*, February 21, 1997.

299. Alvaro Robayo, Marcol, personal communications, March 5, 1997.

300. Bernardo Erazo, Production Manager, C.I. Océanos, personal communications, April 21, 1997.

301. Roberto Osbina, Owner, Pescaderia Asturiana, personal communications, March 24, 1997.

302. Adriana Osbina, Manager, Pescaderia Asturiana, personal communications, March 20, 1997.

303. R. Osbina, *op. cit.*, March 24, 1997.

304. Diego Canelos, Manager, Atunes de Colombia, personal communications, March 10, 1997.

305. Freddy Escamilla, Production Manager, Vikingos, personal communications, March 6, 1997.

SECTION XII. (MARKETS)

306. Alzate, "Industrialización ...," *op. cit.*, p. 190.

307. Carol Jo Sanner, "The Marketing system of the artisanal fishery of the Cartagena Bay Area, Colombia," unpublished report prepared for the Centro de Investigaciones Pesqueras, 1978.

308. Rey, *op. cit.*, March 11, 1996.

309. Hernández, "Dinámica del sector pesquero ...," *op. cit.*, p. 74.

310. Rey, *op. cit.*, March 12, 1997.

311. Hernández, "Dinámica del sector pesquero ...," *op. cit.*, p. 75.

312. Rey, *op. cit.*, March 11, 1996.

313. Padilla, *op. cit.*, February 28, 1997.

314. R. Osbina, *op. cit.*, March 24, 1997.

315. Rey, *op. cit.*, March 12, 1997.

316. Martínez and Gonzalez Porto, "Evaluación de una unidad pesquera ...," *op. cit.*, p. 155.

317. Details on Colombian fishery exports are available in Hernández, "Dinámica ...," *op. cit.*, pp. 74-75.

318. The authors do not have Colombian export data and thus rely on the import data of major market countries, like Japan, the European Union, and the United States.

319. Rey, *op. cit.*, March 12, 1997.

320. U.S. Department of State, "Colombia--Embargo on tuna exports to the U.S.," message number 15619, January 20, 1995. Efforts are currently under way in the U.S. Congress to modify U.S. regulations.

321. With the exception of small quantities of shark fins.

322. Details on Colombian fishery imports are available in Hernández, "Dinámica ...," *op. cit.*, pp. 74-78.

SECTION XIII. (GOVERNMENT AGENCIES AND POLICIES)

323. Nicolás Loreda, Deputy Director, Colombian Government Trade Bureau, Washington, D.C., personal communications, September 14, 1993.

324. INPA Acuerdo No. 5, June 23, 1995.

325. U.S. Embassy, Bogota, message number 8912, June 29, 1995.

326. Rey, *op. cit.*, March 12, 1997.

327. Law No. 10, August 4, 1978.

328. Decree 2256 of 1991. For details on the Colombian licensing program see Weidner and Hall, "Latin America," *op. cit.*, pp. 345-347.

329. Rey, *op. cit.*, March 12, 1997.

330. Rey, *op. cit.*, March 12, 1997. Vessels operating with these licenses are referred to as unaffiliated in appendix A6d.

331. Alzate, "Industrialización ...," *op. cit.*, p. 160.

332. "Con el agua al cuello," *Semana*, February, 1984, pp. 34-35.

333. FAO had initiated a program to help developing countries to utilize the resources of 200-mile EEZs. Presidencia de la Republica, Consejero Nacional de Pesca, *Programa PROPESCA*, *op. cit.*, p. 14.

334. Presidencia de la Republica, Consejero Nacional de Pesca, *Programa PROPESCA*, *op. cit.*, pp. 86-87.

335. "Anzuelo para 120,000 pequeños pescadores," *El Tiempo*, July 1, 1989.

336. See for example "El INPA operará con tres regiones: $400 millones para pesca artisanal," *El Tiempo*, November 25, 1991, p. 11C.

337. "Seis proyectos pesqueros," *El Universal*, August 30, 1989.

338. Carlo Tassara and Jorge Rivera F., "Colombia: La capacitación en el sector pesquero artesanal," *EC Fisheries Cooperation Bulletin*, September 1991, p. 15.

339. Lloreda, *op. cit.*, September 14, 1993 and "Colombia," *Aquarius*, July-December, 1993, p. 11.

340. Weidner and Hall, "Latin America," *op. cit.*

341. See for example Manjarres and Gonzalez, "Evaluación ...," *op. cit.*, pp. 145-164.

342. Lloreda, *op. cit.*, September 14, 1993.

SECTION XIV. (RESEARCH)

343. U.S. Embassy, Bogota, "World swordfish fisheries study: Colombian information," message number 8912, June 29, 1995.

344. U.S. Embassy, Bogota, message number 8912, June 29, 1995.

345. Rey, *op. cit.*, March 12, 1997.

346. Manjarres Martinez and Gonzalez Porto, "Evaluación ...," *op. cit.*, pp. 145-164.

347. Padilla, *op. cit.*, February 28, 1997.

348. Ley 29 (1990) and Decreto 393 (1991).

349. Cesar Fernando García-Llano, Programa de Biodiversidad y Ecosistemas Costeras, Instituto de Investigaciones Marinas y Costeras (INVEMAR), personal communications, August 22, 1997.

350. Chalela Martínez, *op cit.*, February 27, 1997.

351. A.S. Bogdanov, *Soviet-Cuban Fishery Research*, 1965, translated by NMFS, 1969.

352. For details see the individual country chapters.

353. See for example Nakano, "Stock status of swordfish ...," *op. cit.*

354. An brief overview of the Japanese statistical system is available in Hideki Nakano, "Review of data collection system for the Japanese longline fishery and problems about standardization of CPUE," *Collective Volume of Scientific Papers*, XLIII (ICCAT: Madrid, 1996), pp. 159-161. Statistical efforts by the Japanese to adjust swordfish data for changes in fishing strategy over time are explained in H. Nakano, "An update of

Japanese longline standardized CPUE for the Atlantic swordfish," *Collective Volume of Scientific Papers*, XLII (1) (ICCAT: Madrid, 1994), pp. 281-284.

355. Giudicelli, "La pesca artisanal ...," *op. cit.*, p. 8.

356. For details see the Venezuelan chapter of this report.

357. National Fisheries Research and Development Agency, "Fishery statistics and fishing grounds for the Korean tuna longline fishery," *Technical Report*, No. 106, December, 1993, and Tuna Research Center, *Annual Catch Statistics of Taiwanese Tuna Longline Fishery* (Institute of Oceanography: Taipei, December 1993).

358. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*

SECTION XV. (BY-CATCH)

359. Rey, *op. cit.*, March 26, 1997.

360. For details in overall fishing operations of distant-water countries, see the individual country chapters of this study.

361. More information is available on bycatches in the western Pacific, although the data there has been described as very poor by some analysts. A good overview is available in Kevin Bailey, Peter G. Williams, and David Itano, "By-catch and discards in western Pacific tuna fisheries: A review of SPC data holdings and literature," *Oceanic Fisheries Program Technical Report*, No. 34 (South Pacific Commission: Noumea, New Caledonia, 1996). The authors know of no similar review on ETP by-catch trends, but some of the trends in the western Pacific may offer some insights on ETP bycatches.

362. This Japanese western Pacific data is for the actual catch and not the retained portion landed. Kevin Bailey, Peter G. Williams, and David Itano, "By-catch and discards in Western Pacific tuna fisheries: A review of SPC data holdings and literature," *Oceanic Fisheries Programme Technical Report*, No. 34 (South Pacific Commission (SPC): Noumea, New Caledonia, 1996), p. 4.23.

363. De la Pava, *op. cit.*, February 26, 1997 and Erazo, *op. cit.*, April 21, 1997.

364. R. Osbina, *op. cit.*, March 24, 1997. Blues and makos are also commonly taken in the western Pacific longline fishery. The authors note that Japanese practices in the western Pacific are to retain makos, but fin the blues and discard the carcasses. As a result some western Pacific countries (such as Australia) prohibit finning and as a result markets for blue shark have improved. Bailey, *et. al.*, "By-catch and discards ..., *op. cit.*, p. 4.13.

365. Valverde, *op. cit.*, February 24, 1997.

366. De la Pava, *op. cit.*, February 26, 1997.

367. Note the Japanese swordfish catch reported to FAO (Latin America, appendix C2b). Also see the Japanese chapter of this report. Wildman, "Asia," *op. cit.*

368. Padilla, *op. cit.*, February 28, 1997.

369. Rey, *op. cit.*, April 8, 1997.

370. Valverde, *op. cit.*, February 24, 1994.

371. De la Pava, *op. cit.*, February 26, 1997.

372. Betancourt, *op. cit.*, February 21, 1997.

373. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 8-11.

374. Some Colombian authors refer to "tortuga negra" (*Chelonia agassizi*) or black sea turtle. Biologists have not yet reached a consensus as to whether this is a subpopulation of green turtles (*C. mydas*) or a separate species. Green turtles are found in both the Atlantic and Pacific, but black turtles have a much more limited range, primarily the eastern Pacific.

375. Diego Muñoz, Mónica Alfaro, Laura Maria Blain, and Néstor Anzola, "Sea turtles in Buritaca-Don Diego, Colombia," *Marine Turtle Newsletter*, April, 1989, pp. 9-11.

376. A good review of the status of turtles along the coast of Colombia and interactions with artisanal and commercial fisheries is available in Larry Ogran, NMFS memo, "Trip report: Travel to Colombia, S.A., June 7-18, 1983," July 13, 1983.

377. José Vicente Rueda A., "Dying turtles in Colombian waters still a mystery," Marine Turtle Newsletter, July 1990, pp. 4-6.

378. U.S. Embassy, Bogota, "Environmental update," message number 3350, March 2, 1990.

379. Rueda, "Dying turtles ...," *op. cit.*

380. Similarly little information is available on turtle bycatches in the western Pacific longline fishery. Bailey, *et.al.*, "Bycatch and discards ...," *op. cit.*, p. 4.21.

381. Betancourt, *op. cit.*, February 21, 1997.

382. Barbara Schroeder, Sea Turtle Coordinator, NMFS, personal communications, February 24, 1997.

383. Bailey, *et. al.*, "By-catch and discards ...," *op. cit.*, table 4.29.

384. "Turtle skins seized," *Fishing News International*, May 1985.

385. Hook rates were 0.12-1.15 per 100,000 hooks withe highest rates reported within the EEZ. Robert A. Dollar, "Annual report of the 1993 Western Pacific longline fishery," *Southwest Fisheries Center Administrative Report* H-94-06, August, 1994, pp. 9, 24-25.

386. Rene Marquez, Mexican National Turtle Coordinator, comments at Mexican-United States Fishery Cooperation Talks, September 25, 1997, Huatulco, Mexico.

387. While the satellite tracking devices were attached to only a few turtles, the preliminary results are striking. All of the tagged turtles moved due south toward Chile. Scott Eckert, Hubbs Sea World, personal communications, September 25, 1997.

388. See the Ecuadorean, Peruvian, and Chilean chapters of this report for a discussion of interactions between turtles and fisheries.

389. Erazo, *op. cit.*, April 21, 1997.

390. R. Osbina, *op. cit.*, March 24, 1997 and Erazo, *op. cit.*, April 21, 1997.

391. Y. Uozumi, "Swordfish by-catch by the Japanese longline fishery in the recent years," *Collective Volume of Scientific Papers*, XLII (1) (ICCAT: Madrid, 1994), pp. 285-287.

392. R. Osbina, *op. cit.*, March 24, 1997.

393. Manjarres and Gonzalez, "Evaluación de una unidad ...," *op. cit.*, p. 148.

394. Diego Muñoz, Mónica Alfaro, Laura Maria Blain, and Néstor Anzola, "Sea turtles in Buritaca-Don Diego, Colombia," *Marine Turtle Newsletter*, April, 1989, pp. 9-11.

395. Erazo, *op. cit.*, April 21, 1997.

SECTION XVI. (INTERNATIONAL)

396. The authors note that Ecuador since 1995 has begun to land increasing quantities of swordfish, targeting grounds to the west of the Galápagos. In addition, Costa Rica in 1996 began to export sharply higher quantities of swordfish. For details see the individual country chapters.

397. Mexican officials are currently studying requests to authorize longline fishing.

398. U.S. Embassy, Bogota, "Application by Colombia to join the Inter-American Tropical Tuna Commission (IATTC)," message number 3861, March 13, 1992.

399. See for example, Hinton and Deriso, "Structure and assessment ...," *op. cit.*

400. An overview of the activities of the various countries is available in Weidner and Hall, "Latin America," *op. cit.*

401. For details on flag-of-convenience operations see Weidner and Hall, "Latin America," *op. cit.*

402. Zapata Navarro, *op. cit,*, August 4, 1977.

403. "Maritime agreement signed," San Jose Radio Monumental, 1720 GMT, March 17, 1977.

404. For details see the Cuban chapter of this report.

405. Giudicelli, "La pesca artisanal ...," *op. cit.*, p. 8.

406. See the Cuban chapter of this report for details.

407. No further details are available on this vessel, but for an overview of the Cyprus swordfish fishery see the European section of this report.

408. "Dominican foreign minister arrives for a visit," Bogota Cadena Radial Super, 0000 GMT, February 14, 1979 and U.S. Embassy, Bogota, "Maritime boundaries of Colombia," message number A17, April 13, 1981.

409. U.S. Embassy, Quito, "Agreement on the delimitation of marine and sub-marine areas and marine cooperation between Ecuador and Colombia," message number 6269, August 26, 1975.

410. See the Ecuadorean chapter of this report for details.

411. The Ecuadoreans reported a substantial marlin bycatch around Malpelo Island. Betancourt, *op. cit.*, February 21, 1997.

412. U.S. Embassy, Bogota, "GOC European Community initiative," message number 5950, April,24, 1989.

413. INFOFISH, "Preferential duty rates to be withdrawn," *Trade News*, December 15, 1994.

414. The Colombians could export tuna caught by Colombian and licensed foreign vessels within the EEZ or Colombian vessels beyond the EEZ, but not foreign tuna merely transshipped through Colombia. "Colombia tampoco cumple," *Industrias Pesqueras*, June 10, 1995. p. 21.

415. See the Peruvian chapter of this report for details.

416. "Sanciona Colombia un acuerdo sobre frontera marítima con Haití," *Diario las Americas*, November 25, 1978.

417. "Maritime treaty with Honduras approved," *El Tiempo*, October 24, 1986.

418. For details on the overall Panamanian effort off Colombia see Weidner and Hall, "Latin America," *op. cit.*, p. 346.

419. For details on flag-of-convenience operations see Weidner and Hall, "Latin America," *op. cit.*

420. U.S. Embassy, Kingston, "Jamaica-Colombia fishing accord," message number 8862, October 16, 1981 and "Fishing pact with Colombia," *The Daily Gleaner*, August 25, 1984.

421. Discussions on the boundary were conducted during the early 1990s. "Colombia y Jamaica delimitan sus áreas marinas en Cartagena," *El Universal*, April 29, 1992.

422. De la Pava, *op. cit.*, February 26, 1997 and R. Osbina, *op. cit.*, March 24, 1997.

423. Giudicelli, "La pesca artisanal ...," *op. cit.*, p. 8.

424. Uozumi, "Preliminary analysis ...," *op. cit.*, p. 29 and ICCAT, "1994 SWO background document: Figures," *ICCAT Collective Volume of Scientific Papers*, XLIV (3) (ICCAT: Madrid, Spain, 1995), p. 91.

425. More detailed data on the Japanese Pacific fishery off Colombia are discussed under "Fishing Ground."

426. Uozumi and Yokawa, "Country report ...," *op. cit.*, p.6

427. Uozumi and Yokawa, "Country report ...," *op. cit.*, p.6

428. The species composition in recent years appears to have shifted from primarily stripped marlin to mostly blue marlin. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, maps 8-13. Sailfish catches were not included in the source.

429. "Fishery pacts," Seoul, Haptong 0253 GMT, February 13, 1978.

430. For overall details on the Korean swordfish fishery, see the Korean chapter of this report. Wildman, "Asia," *op. cit.*

431. Korean National Fisheries Research and Development Agency (NFRDA), "Fishery statistics and fishing grounds for the Korean tuna longline fishery, 1988-1992," *Technical Report of the NFRDA* (NFRDA: Seoul, December 1993), pp. 87, 300, and 314.

432. While much of Korea's tuna catch is taken by longliners, the country also deploys some purse seiners. See, for example, "South Korea goes for west Pacific tuna, *Fishing News International*, March 1983, p. 3.

433. "Cooperation with Mexico," Bogota home service, 1730 GMT, July 18, 1983.

434. For details see the Ecuadorean chapter of this report.

435. U.S. Embassy, Panama, "Colombia-Panama marine boundary convention," message number A163, November 23, 1976.

436. For details on the overall Panamanian effort off Colombia see Weidner and Hall, "Latin America," *op. cit.*, p. 346.

437. For details on flag-of-convenience operations see Weidner and Hall, "Latin America," *op. cit.*, pp. 233-237.

438. The vessels appear to be small seiners and trawlers. Weidner and Hall, "Latin America," *op. cit.*, pp. 243 and 459.

439. For details on the St. Vincent flag-of-convenience operations see Weidner and Hall, "Latin America," *op. cit.*, pp. 147-148.

440. ICCAT, "1994 SWO background document: Figures," *op. cit.*, p. 91.

441. For details see the Chilean and Peruvian chapters of this report. Overall details of the Spanish swordfish fishery are available in the Spanish chapter of this report. Folsom, "Western Europe," *op. cit.*

442. Tuna Research Center (TRC), *Annual Catch Statistics of Taiwanese Tuna Longline Fishery* (TRC/Institute of Oceanography/National Taiwan University: Taipei, December, 1993), p. F21.

443. TRC, *Annual Catch Statistics ...*, *op. cit.*, p. F21-24. For details on the overall Taiwan swordfish fishery, see the Taiwan chapter of this report. Wildman, "Asia," *op. cit.*

444. TRC, *Annual Catch Statistics ...*, *op. cit.*, pp. 17 and F5-8. The authors note, however, that published Taiwan statistics probably do not include large numbers of Taiwan-owned vessels reflagged in Honduras, Panama, and other countries.

445. For details on flag-of-convenience operations see Weidner and Hall, "Latin America," *op. cit.*

446. Jean Cramer, "Large pelagic logbook newsletter-1994," *NOAA Technical Memorandum*, NMFS-SEFSC-378, November 1995, p. 3 and Jean Cramer, "Large pelagic logbook newsletter-1995," *NOAA Technical Memorandum*, NMFS-SEFSC-394, November 1996, p. 3.

447. The U.S. Pacific swordfish longline fleet primarily operates in the north Pacific out of Honolulu fishing grounds north of the Hawaiian Islands. A few longliners have also operated out of Californian ports. See the U.S. chapter of this report for details. Fishing effort along the coast of South America has been very limited, although a few vessels have been deployed off Chile outside the 200-mile limit. See the Chilean chapter of this report for details.

448. Zapata Navarro, *op. cit.*, August 4, 1997.

449. Arocha, *op. cit.*, February 2, 1997.

450. U.S. Embassy, Bogota, "Colombia's fisheries industry ...," *op. cit.*

451. Edmer Tovar M., "Buenaventura entró en la era del atún," *El Tiempo*, January 24, 1989.

452. U.S. Embassy, Bogota, "Colombian-Japanese joint venture tuna fishing company," message number 11062, November 17, 1975.

453. Craig Felber, NMFS, personal communications, April 11, 1975.

454. "Colombia to boost fleet," *World Fishing*, November, 1994, p. 21.

455. U.S. Embassy, Mexico, "Mexican-Colombian tuna cooperation," message number 14227, September 14, 1983.

456. U.S. Embassy, Bogota, "Mexican-Colombian tuna cooperation," message number 9654, September 6, 1983.

457. U.S. Embassy, Bogota, "Polish Colombian joint fisheries ventures," message number 10306, October 25, 1978 and U.S. Embassy, Warsaw, "Polish-Colombian joint fisheries venture," message number 7935, September 8, 1978.

458. "Colombia and Spain agree fishery plans," *Eurofish Report*, October 20, 1982, FS/5.

459. "Quotas, limits, arrests, and now ...," *Fishing News International*, February 1982.

460. "Danish firms convert ships for Colombia," *Fishing News International*, May 1988.

461. INFOPESCA "Convenio pesquero para procesamiento de atún," *Notas Comerciales*, February 20, 1989.

462. "Aid tops $46 million," *Fishing News International*, April 1980, p. 27.

463. Magnus Magnusson, Director, personal communications, March 23, 1990.

464. "Colombia: Surgimiento de la pesquería del atún en Colombia," *Aquarius*, N°50, October-December 1992, p. 9.

465. "CE apoya desarrollo pesquero de paises andinos," *Aquarius*, July-December, 1993.

466. "Crucero exploratorio en el Caribe," *El Tiempo*, January 21, 1995, p. 2B.

467. FAO, "Proyecto de pesca continental desarrollado en Colombia, 1959-60," *Programa Ampliado de Asistencia Técnica*, N°1304 (FAO: Rome, 1961).

468. Proyecto para el desarrollo de la Pesca Marítima en Colombia, *Boletín Informativo* (FAO/INDERENA: Bogota, early 1970s), various issues and U.S. Embassy, Bogota, Evaluation of United Nations assistance programs in Colombia," message number 1-264, June 6, 1969.

469. Giudicelli, "La pesca artesanal ..., *op. cit.*

470. Presidencia de la Republica, Consejero Nacional de Pesca, *Programa PROPESCA*, *op. cit.*, p. 14.

471. FAO, *Estrategias para la Ordenación de la Pesca* (Rome: FAO, 1986).

472. Funding is through the Italian CISP program. Manjarres, *op. cit.*, February 24, 1997.

473. "Japanese fishing loan," Bogota Radio Cadena, Nacional, 1730 GMT, November 7, 1977.

474. "Japan donates funds to promote fishing industry," *El Siglo*, November 20, 1979.

475. "Colombia to boost fleet," *World Fishing*, November 1984, p. 12.

476. "Japanese loan for maritime research announced," *El Tiempo*, October 23, 1988, p. 7B and INFOPESCA, "Colombia: Hacia la diversificación de la producción industrial," *Notas Comerciales*, March, 5, 1991.

477. U.S. Embassy, Tokyo, "Japanese grant to Colombia," message number 900, January 18, 1989.

478. "Colombia to build ...," *op. cit.*

479. "Con $300 millones ...," *op. cit.*

480. "Fishery pact with China, *China Post*, April 21, 1976.

481. See for examples papers delivered at the III Seminario Nacional de Acuicultura, Universidad del Valle, Cali, November-December 1979.

482. "Norway gives fishing aid to Colombia," *Dansk Fiskeritidende*, September 27, 1979; "Norwegians get 20 boats off Colombia," *Fishing News International*, October 1979, p. 11; "Colombia: Proyecto pesquero noruego," *Industrias Pesqueras*, March 15, 1980; and "Danish firms convert ships for Colombia," *Fishing News International*, May 1988, p. 31.

SECTION XVII (ENFORCEMENT)

483. "Five tuna boats of unknown origin machine-gunned," Paris AFP, 0045 GMT, July 23, 1980.

484. "Fishermen tell of mistreatment in Cuban jails," Madrid, EFE 0325 GMT, November 4, 1977.

485. "Vessel reportedly detained by the Colombian Navy," Quito Voz de los Andes, 1230 GMT, January 24, 1988.

486. "Navy captures 3 Ecuadorean fishing vessels," Hamburg DPA, 2337 GMT, February 20, 1987.

487. "Colombian ship caught fishing without permit," Paris AFP, 2229 GMT, July 3, 1979.

488. "Authorities detain Honduran boat, crew," Bogota Emisoras CARACOL, 1215 GMT, March 19, 1984.

489. "Illegal Japanese tuna fishing off South America," *Kyodo*, April 11, 1994.

490. "Mexican fishing ship seized off Pacific coast," Bogota Inravisión Televisión Cadena 1," 1215 GMT, April 29, 1987.

491. "Navy releases 10 detained fishing boats," Paris, AFP 2235 GMT, April 12, 1982.

492. The Sandinistas revived the country's claims to the offshore Caribbean islands by renouncing the Barcenas-Meneses-Esguerra Treaty which has established a marine boundary.

493. "Release of seven Colombian fishermen announced," Managua Radio Noticias, 1930 GMT, June 29, 1982.

494. "Attack on Colombian fishing fleet reported," Panama City, Televisora Nacional, 0058 GMT, January 9, 1988.

495. "Incidente marítimo entre Nicaragua y Colombia a 120 millas de Puerto Cabezas," *Diario las Americas*, January 24, 1980, and "Colombian Navy interference with fishing boats protested," Managua Radio Sandino, 0300 GMT, January 23, 1980.

496. U.S. Embassy, Bogota, "Nicaraguan seizure of Colombian fishing vessel," message number 15385, October 29, 1986.

497. "Military presence increased around San Andrés Island," Bogota, Inravisión Televisión Cadena 1, 0130 GMT, August 29, 1993.

498. "Soberano lío en la zona rosa, *Semana*, June 21, 1994.

499. "Panamanian fishing boat seized; crew arrested," Bogota Radio Sutatenza, 1200 GMT, October 8, 1980.

500. "Authorities seize U.S., Panamanian boats," Madrid EFE, 0315 GMT, July 9, 1986.

501. "Maritime service captures 2 Colombian boats in local waters," *La Prensa*, July 17, 1983.

502. U.S. Embassy, Bogota, "Nicaraguans seize Colombian fishing vessels," message number 5149, April 17, 1995.

503. Flover G. Gonzalez, "Con tráfico de influencias diplomáticas," *El Espectador*, January 19, 1991.

504. U.S. Consulate, Baranquilla, "U.S. fishing boat 'Bon Chance'," message number 349, August 3, 1981.

505. "Authorities seize U.S., Panamanian boats," Madrid EFE, 0315 GMT, July 9, 1986.

506. U.S. Consulate, Baranquilla, "Vessel 'Pices'," message number 24, January 26, 1987.

507. Rolf Juhl, NMFS memorandum, April, 15, 1981.

508. U.S. Department of State, "Fishing issues: Prospector I and Quita Sueño," (sic.) message number 112142, April 10, 1985; U.S. Embassy, Bogota, "Foreign Ministry note alleges violation of 1972 Vásquez-Saccio fishing treaty," message number 14684, October 22, 1987; and U.S. Embassy, Bogota, "GOC protests alleged violation of 1972 Vásquez-Saccio fishing treaty," message number 6536, April 29, 1988.

509. U.S. Embassy, "Update - U.S. fishing boat Sitex-7," message number 5309, April 7, 1994.

510. "Company charges Venezuela detains ships," Paris AFP, 1610 GMT, January 20, 1986.

511. "Colombia protesta ante el gobierno venezolano," *El Universal*, January 22, 1986.

512. "Three killed in Venezuelan border incident," Bogota, Cadena Radial Super, 1730 GMT, January 17, 1988.

513. "Local, Venezuelan officials on fishing vessel incident," Bogota, Inravisión Televisión Canal A, September 19, 1995, and "Samper on fishing boat incident, Venezuela's stance," *El Tiempo*, September 19, 1995. pp. 1, 8A.

514. "Release of fishermen," *The Daily Gleaner*, July 14, 1981, p. 1.

515. "British trawler, crew taken into custody," Bogota Radio Cadena Nacional, 1200 GMT, October 11, 1989.

516. Guerrilleros asesinan a 8 pescadores en la provincia colombiana de Antioquia," *Diario las Americas*, January 29, 1988, p. 3A.

517. "En Colombia," *Técnica Pesquera*, April, 1981, p. 35.

518. U.S. Embassy, Bogota, "Ship search: M/N Gulf Wave, Reg. No. 356584 and marine transportation," message number 6307, June 15, 1979.

519. "Pirates attack ship," Paris AFP, 1627 GMT, October 15, 1979.

520. Arocha, *op. cit.*, July 7, 1997.

APPENDICES

Series A: Fleet
Series B: Catch
Series C: Processing
Series D: Agencies/Companies
Series E: Trade
  E1: Overall fisheries
  E2: Overall swordfish
  E3: United States
  E4: Japan
Series F: Licenses
Series G: Glossary

Appendix A1a.--Colombia. Commercial fishing fleet, 1992-95

Year	Vessels		Total
	Domestic	Foreign*	
	Number		
1992	252	215	467
1993	NA	150	NA
1994	156	174	330
1995	192	168	360

* Foreign vessels licensed and working in association with Colombian companies.
Source: INPA/ANDI in Armando Hernández R., "Dinamica del sector pesquero en los años 90," *ANDI*, March-April 1995, pp. 71-72 (1992 and 1994 data); INPA, unpublished statistics, August 5, 1993 (1993 data); and INPA, *Boletín Estadistico Pesquero*, 1995 (1995 data).

Appendix A1b.--Colombia. Domestic fishing fleet, 1980-93

Year	Size (GRT)			Total	
	100-499	500-999	1,000-1,999	Vessels	Tonnage
		Number		Number	GRT
1980	8	-	-	8	1,122
1981	8	-	-	8	1,122
1982	9	1	-	10	2,012
1983	17	1	-	18	3,103
1984	17	-	-	17	2,275
1985	16	-	-	16	2,148
1986	17	-	-	17	2,258
1987	17	-	-	17	2,258
1988	17	-	-	17	2,258
1989	16	-	-	16	2,148
1990	16	-	-	16	2,148
1991	17	-	-	17	2,490
1992	18	1	2	21	5,922
1993	NA	NA	NA	24	7,700

Source: Lloyd's, *Lloyd's Register of Shipping*, various years.

Appendix A2.--Colombia. Licensed foreign vessels, 1992-95

Country	Vessels			
	1992	1993	1994	1995♦
		Number		
Panama	64	44	51	NA
Honduras	NA#	25	31	NA
Belize	NA#	-	27	NA
United States	21	26	17	NA
Venezuela	15	11	14	NA
Ecuador	19	3	12	NA
Vanuatu	35	11	11	NA
Japan	22	15	NA#	NA
Others	39*	NA**	11***	NA
Total	215	150	174	168

NA - Not available
♦ The country breakdown of the licensed foreign tuna vessels is available in appendix A5b.
* Honduras, Russia, Spain and others.
** Dominican Republic, Korea, Mexico, New Zealand, Russia, Spain, and United Kingdom.
*** Dominican Republic, Mexico, Nicaragua, and others.
# Included in others.
Source: INPA/ANDI in Armando Hernández R., "Dinamica del sector pesquero en los años 90," *ANDI*, March-April 1995, pp. 71-72 (1992 and 1994 data); and INPA, unpublished statistics, August 5, 1993 (1993 data); INPA, *Boletín Estadistico Pesquero*, 1995 (1995 data).

Appendix A3a.--Colombia. Domestic and foreign vessels, 1992-95

Fishery	Vessels			
	1992	1993	1994	1995
		Number		
Shrimp				
Coastal	NA	NA	NA	120
Deepwater	NA	NA	NA	27
Total	246	NA	149	147
Tuna	67	NA	64	82
Demersal fish##	109	NA	72	63
Conch/lobster	35	NA	39	10
Small pelagics	10	NA	6	16
Multi-purpose***	NA	NA	NA	42
Total	467	NA	330	360

* Honduras, Russia, Spain and others.
** Dominican Republic, Mexico, and Nicaragua.
# Included in others.
Referred to as "pesca blanca" or white fish.
*** Polivalentes
Source: INPA/ANDI in Armando Hernández R., "Dinamica del sector pesquero en los años 90," *ANDI*, March-April 1995, pp. 71-72 (1992-93 data) and INPA, *Boletín Estadistico Pesquero*, 1995 (1995 data).

Appendix A3b.--Colombia. Licensed fishing vessels, 1995

Type	Pacific		Caribbean		San Andres		Total	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
	Number of vessels							
Tuna	15	29	7	31	-	-	22	60
Shrimp								
Coastal	62	5	25	27	-	1	87	33
Deepwater	8	19	-	-	-	-	8	19
Total	70	24	25	27	-	1	95	52
Small pelagics*	7	1	-	8	-	-	7	9
Lobster	-	-	-	-	-	7	-	7
Conch	-	-	-	3	-	-	-	3
Demersal	44	9	1	3	2	4	47	16
Multiple gear	11	5	5	6	5	10	21	21
Total	147	68	38	78	7	22	192	168

* Coastal
INPA, *Boletín Estadistico Pesquero*, 1995 (1995 data).

Appendix A4.--Colombia. Caribbean coast fishing vessels, 1982-1993.

Year	Longliners	Purseseiners*				Other	Total
		<200	201-300	301-400	>401		
		Number of vessels					
1982	-	-	-	-	-	-	-
1983	-	-	-	-	-	-	-
1984	-	-	-	-	-	-	-
1985	-	-	-	-	-	-	-
1986	-	-	-	-	-	-	-
1987	-	-	-	-	-	-	-
1988	-	-	-	-	-	-	-
1989	-	-	-	-	-	-	-
1990	-	-	-	-	-	-	-
1991	-	-	-	-	-	-	-
1992	-	-	1	1	3	-	5
1993	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-
1995	-	-	-	-	-	-	-

Note: ICCAT is reporting vessels active in the Caribbean. Colombian fishermen have deployed several seines in the 1990s, but they are apparently mostly operating in the Pacific.
* By tonnage
Source: ICCAT. *Statistical Bulletin*, 1995 (ICCAT: Madrid, 1996), p. 73.

Appendix A5a.--Colombia. Licensed fishing vessels, 1995

Vessel	Company	Size	Country	Target species	Port
		NRT			
Adalgiz II	Copromar	72.00	Belize	Tuna	Cartagena
Adriana	Copescol	57.26	Ecuador	Tuna	Buenaventura
Aleta Amarilla	Industrial Pesquera C/Biana	506.80	Mexico	Tuna	Cartagena
Aleta Azul	Atunec S.A.	506.82	Mexico	Tuna	Barranquilla
Alize	Frigopesca	250.00	St. Vincent	Tuna	Cartagena
Amanda	Atunes De Colombia	450.00	Vanuatu	Tuna	Cartagena
America Eagle	Atunes De Colombia	459.00	Colombia	Tuna	Cartagena
Ana Maria F.	Copescol	205.58	Ecuador	Tuna	Buenaventura
Andrea II	Explopesca Ltda.	171.00	Panama	Tuna	Cartagena
Ann Mary	Frigogan	87.96	Venezuela	Tuna	Barranquilla
Antiqueño	Jorge E. Guzman Arias	30.62	Colombia	Tuna/finfish	Buenaventura
Atlantis	Frigogan	585.00	USA	Tuna	Barranquilla
Betty Eliabeth	Frigopesca	90.60	Ecuador	Tuna	Cartagena
Bold Aventures	Frigogan	579.00	USA	Tuna	Barranquilla
Cabo De Hornos	Atunes De Colombia	555.21	Vanuatu	Tuna	Cartagena
Cabo San Lucas	Industral Pesquera C/Biana	466.20	Mexico	Tuna	Cartagena
Calipso 82	Filetes Del Mar & Cia Ltda	88.00	Colombia	Tuna	Buenaventura
Canaima	Vikingos	340.34	Venezuela	Tuna	Cartagena
Cape San Vincent	Frigogan	301.00	USA	Tuna	Barranquilla
Captain Vincent Gann	Frigogan	689.00	USA	Tuna	Barranquilla
Charo	Copescol	494.00	Belize	Tuna	Buenaventura
Chiyoda Maru 11	Inpesca	113.58	Japan	Tuna	Buenaventur
Chiyoda Maru 33	Inpesca	173.40	Japan	Tuna	Buenaventura
Ciudad de manta	Atunes De Colombia	74.24	Ecuador	Tuna	Cartagena
Connie Jean	Marisol Del Pacifico	208.00	USA	Tuna	Buenaventura
Diane Marie	Marcol	152.91	Panama	Tuna	Tumaco
Dominador	Atunes De Colombia	57.17	Ecuador	Tuna	Cartagena
Don Abel	Frigopesca	391.92	Venezuela	Tuna	Cartagena
Don Antonio	Propescol	472.00	Colombia	Tuna	Buenaventura
Don Celso	Frigopesca	208.74	Panama	Tuna	Cartagena
Don Efra	Efrain Salazar	44.00	Colombia	Cas/Tuna	Buenaventura
Don Esteban	Exploesca	40.99	Panama	Tuna/finfish	Cartagena
Don Fausto	Propescol	472.00	Colombia	Tuna	Buenaventura
Don Nacho	Madenar Ltda.	66.80	Colombia	Tuna/finfish	Buenaventura
Don Quijote	Atunec S.A.	170.80	Ecuador	Tuna	Barranquilla
Don Sabastian	Explopesca	61.64	Panama	Tuna/finfish	Cartagena
Eastbound One	Carlos Eduardo Castrillon	132.00	Belize	Tuna/finfish	Tumaco
Eileen Marie	Commercial El Delfin Blanco	133.00	Panama	Tuna	Tumaco
El Dorado	Atunes De Colombia	172.30	Colombia	Tuna	Cartagena
El Gringo	Emp. Nat. De Pesca Martima	55.00	Colombia	Tuna/finfish	Buenaventura
El Rey	Atunes De Colombia	450.00	Vanuatu	Tuna	Cartagena
El Rifle	Frigogan	507.80	Venezuela	Tuna	Barranquilla
Emperador	Copescol	41.00	Ecuador	Tuna	Buenaventura
Enterprise	Atunes De Colombia	594.00	Colombia	Tuna	Cartagena

Erasmo F.	Copescol	270.54	Ecuador	Tuna	Buenaventura
Fiorella L.	Frigopesca	205.58	Ecuador	Tuna	Cartagena
Flamarca VII	Atunec S.A.	591.54	Venezuela	Tuna	Barranquilla
Flamarca VIII	Atunec S.A.	591.54	Venezuela	Tuna	Barranquilla
Flamarca IX	Atunec S.A.	461.00	Venezuela	Tuna	Barranquilla
Gabriela A.	Copescol	143.43	Ecuador	Tuna	Buenaventura
Gemenis	Frigomarina	62.00	Panama	Tuna	Buenaventura
Genisis	Frigopesca	355.92	Venezuela	Tuna	Cartagena
Gertruz II	Copromar	72.00	Belize	Tuna	Cartagena
Gloria A.	Copescol	243.00	Ecuador	Tuna	Buenaventura
Grenadier	Arunes De Colombia	412.92	Colombia	Tuna	Cartagena
Hamashumaru	Copescol	160.13	Japan	Tuna	Buenaventura
Ingalapagos	Copescol	141.69	Ecuador	Tuna	Buenaventura
Intrepido	Marcol	42.11	Ecuador	Tuna	Buenaventura
Isabel 2	Copescol	372.60	Ecuador	Tuna	Buenaventura
Isabel 4	Copescol	372.60	Ecuador	Tuna	Buenaventura
Isabel 5	Copescol	489.74	Spain	Tuna	Buenaventura
Isabel Tuna	Copescol	552.96	Cyprus	Tuna	Buenaventura
Isomae Maru 21	Copescol	240.00	Japan	Tuna	Buenaventura
Jacques Cartier	Atunec S.A.	376.09	Ecuador	Tuna	Barranquilla
Jambeli	Atunec S.A.	157.71	Ecuador	Tuna	Braranquilla
Jane	Frigopesca	595.00	Venezuela	Tuna	Cartagena
Jane Elizabeth	Frigogan	351.00	Vanuatu	Tuna	Barranquilla
Jenny Margot	Frigogan	544.58	Venezuela	Tuna	Cartagena
Juliana Marie	Ricapesca	190.68	Mexico	Tuna	Buenaventura
Julie L.	Frigogan	586.00	Panama	Tuna	Barranquilla
La Foca	Frigogan	595.00	Venezuela	Tuna	Barranquilla
La Parrula	Frigopesca	368.10	Venezuela	Tuna	Cartagena
Los Roques	Frigogan	395.28	Venezuela	Tuna	Barranquilla
Lucia T.	Atunec S.A.	354.32	Ecuador	Tuna	Barranquilla
Lucile	Frigopesca	367.36	Venezuela	Tuna	Cartagena
Lucy	Atunes De Colombia	80.12	Ecuador	Tuna	Cartagena
Lupe Del Mar	Industral Pesquera C/Biana	506.82	Mexico	Tuna	Cartagena
Marginela	Frigomarina	283.00	Russia	Tuna	Buenaventura
Maria Francisca	Frigopesca	476.01	Vanuatu	Tuna	Cartagena
Marinero Otero	Industral Pesquera C/Biana	449.88	Mexico	Tuna	Cartagena
Marinero	Atunes De Colombia	564.67	Vanuatu	Tuna	Cartagena
Mirelur	Vikingos	503.88	Vanuatu	Tuna	Cartagena
Monteclaro	Frigopesca	327.03	Spain	Tuna	Cartagena
Monte Cristi	Atunes De Colombia	311.33	Ecuador	Tuna	Cartagena
Monteneme	Frigopesca	429.71	Spain	Tuna	Cartagena
Mureks	Frigomarina	283.00	Russia	Tuna	Buenaventura
Myriam	Copescol	101.16	Ecuador	Tuna	Buenaventura
Napoleon	Frigopesca	786.00	Venezuela	Tuna	Cartagena
Nikolek	Frigogan	351.00	USA	Tuna	Barranquilla
Olimpia	Atunes De Colombia	491.00	Vanuatu	Tuna	Cartagena
Orinoco	Vikingos	394.50	Venezuela	Tuna	Cartagena
Pacifico's	Frigogan	395.28	Venesuela	Tuna	Barranquilla

Pamela Ann	Frigogan	420.00	USA	Tuna	Barranquilla
Pampano I	Ramon Elias Vitery	60.00	Honduras	Tuna	Tumaco
Pancho V	Copescol	44.16	Ecuador	Tuna	Buenaventura
Pollux II	Explopesca	71.00	Panama	Tuna/finfish	Cartagena
Ramoncho	Atunes De Colombia	43.22	Ecuador	Tuna	Cartagena
Rebelde	Emp. Nal. De Pesca Maritima	55.00	Colombia	Tuna/finfish	Buenaventura
Roberto A.	Copescol	143.43	Ecuador	Tuna	Buenaventura
Rocio	Comerc. El Delfin Blanco	125.02	Colombia	Tuna	Tumaco
Sabrina	Copromar	155.53	Belize	Tuna/finfish	Cartagena
Sandra C.	Atunes De Colombia	469.00	Colombia	Tuna	Cartagena
Sasano Maru 17	Inpesca	155.83	Japan	Tuna	Buenaventura
Saturno	Copescol	34.75	Ecuador	Tuna	Buenaventura
Sea Rover	Alvaro Buitrago Garces	51.00	Colombia	Tuna	Buenaventura
Sea Royal	Atunes De Colombia	881.72	Vanuatu	Tuna	Cartagena
South Seas	Frigogan	586.00	USA	Tuna	Barranquilla
Sun 701	Inpesca	151.84	Panama	Tuna	Buenaventura
Taganga	Copescol	27.76	Colombia	Tuna	Buenaventura
Taroa	Copescol	27.76	Colombia	Tuna	Buenaventura
Tarqui	Atunes De Colombia	80.12	Ecuador	Tuna	Cartagena
Tauro	Copescol	82.00	Panama	Tuna	Buenaventura
Tiuna	Atunes De Colombia	598.18	Vanuatu	Tuna	Cartagena
Ugavi	Frigopesca	281.00	St. Vincent	Tuna	Cartagena
Victoria 1*	C.I. Oceanos	171.00	Panama	Tuna	Cartagena
Victoria 8*	Pescaderia Asturiana	150.66	Panama	Tuna/finfish	Cartagena
Victoria A	Copescol	300.47	Panama	Tuna	Buenaventura
Victoria 102	Frigopesca	204.09	Korea	Tuna	Cartagena
Victoria 103	Frigopesca	204.09	Korea	Tuna	Cartagena
Western Pacific	Coltuna	265.42	New Zealand	Tuna	Buenaventura
Yelisava	Frigogan	302.00	Vanuatu	Tuna	Barranquilla
Yushu Maru 51	Frigopesca	250.00	Japan	Tuna	Cartagena

* One local observer indicates that these may be the same vessels, after name changes. The differing size is unexplained.
Source: INPA

Appendix A5b.--Colombia. Licensed fishing vessels, by country, 1995

Country/Vessel	Company	Vessel size	Target species	Base Port	Vessel type
		NRT			
Belize					
Adalgiz II	Compomar	72.00	Tuna	Cartagena	
Charo	Copescol	494.00	Tuna	Buenaventura	Purse seiner
Eastbound One	Carlos Eduardo Castrillon	132.00	Tuna/finfish	Tumaco	Combination vessel
Gertruz II	Copromar	72.00	Tuna	Cartagena	
Sabrina	Copromar	155.53	Tuna/finfish	Cartagena	
Colombia					
America Eagle	Atunes De Colombia	459.00	Tuna	Cartagena	Purse seiner
Antiqueño	Jorge E. Guzman Arias	30.62	Tuna/finfish	Buenaventura	Combination vessel
Calipso 82	Filetes Del Mar & Cia Ltda	88.00	Tuna	Buenaventura	
Don Antonio	Propescol	472.00	Tuna	Buenaventura	Purse seiner
Don Efra	Efrain Salazar	44.00	Cas Atun	Buenaventura	
Don Fausto	Propescol	472.00	Tuna	Buenaventura	Purse seiner
Don Nacho	Madenar Ltda.	66.80	Tuna/finfish	Buenaventura	Combination vessel
El Dorado	Atunes De Colombia	172.30	Tuna	Cartagena	Purse seiner
El Gringo	Emp. Nat. De Pesca Martima	55.00	Tuna/finfish	Buenaventura	Combination vessel
Enterprise	Atunes De Colombia	594.00	Tuna	Cartagena	Purse seiner
Grenadier	Atunes De Colombia	412.92	Tuna	Cartagena	Purse seiner
Rebelde	Emp. Nal. De Pesca Maritima	55.00	Tuna/finfish	Buenaventura	Combination vessel
Rocio	Comerc. El Delfin Blanco	125.02	Tuna	Tumaco	Purse seiner
Sandra C.	Atunes De Colombia	469.00	Tuna	Cartagena	Purse seiner
Sea Rover	Alvaro Buitrago Garces	51.00	Tuna	Buenaventura	Purse seiner
Taganga	Copescol	27.76	Tuna	Buenaventura	
Taroa	Copescol	27.76	Tuna	Buenaventura	
Cyprus					
Isabel 5	Copescol	552.96	Tuna	Buenaventura	Purse seiner
Ecuador					
Adriana	Copescol	57.26	Tuna	Buenaventura	Purse seiner
Ana Maria F.	Copescol	205.58	Tuna	Buenaventura	Purse seiner
Betty Eliabeth	Frigopesca	90.60	Tuna	Cartagena	Purse seiner
Ciudad de Manta	Atunes De Colombia	74.24	Tuna	Cartagena	Purse seiner
Dominador	Atunes De Colombia	57.17	Tuna	Cartagena	Purse seiner
Don Quijote	Atunec S.A.	170.80	Tuna	Barranquilla	Purse seiner
Emperador	Copescol	41.00	Tuna	Buenaventura	Purse seiner
Erasmo F.	Copescol	270.54	Tuna	Buenaventura	Purse seiner
Fiorella L.	Frigopesca	205.58	Tuna	Cartagena	Purse seiner
Gabriela A.	Copescol	143.43	Tuna	Buenaventura	Purse seiner
Gloria A.	Copescol	243.00	Tuna	Buenaventura	Purse seiner
Ingalapagos	Copescol	141.69	Tuna	Buenaventura	Purse seiner
Intrepido	Marcol	42.11	Tuna	Buenaventura	Purse seiner
Isabel 2	Copescol	372.60	Tuna	Buenaventura	Purse seiner
Isabel 4	Copescol	372.60	Tuna	Buenaventura	
Jacques Cartier	Atunec S.A.	376.09	Tuna	Barranquilla	Purse seiner

Jambeli	Atunec S.A.	157.71	Tuna	Braranquilla	Purse seiner
Lucia T.	Atunec S.A.	354.32	Tuna	Barranquilla	Purse seiner
Lucy	Atunes De Colombia	80.12	Tuna	Cartagena	Purse seiner
Monte Cristi	Atunes De Colombia	311.33	Tuna	Cartagena	Purse seiner
Myriam	Copescol	101.16	Tuna	Buenaventura	Purse seiner
Pancho V	Copescol	44.16	Tuna	Buenaventura	
Ramoncho	Atunes De Colombia	43.22	Tuna	Cartagena	Purse seiner
Roberto A.	Copescol	143.43	Tuna	Buenaventura	Purse seiner
Saturno	Copescol	34.75	Tuna	Buenaventura	Purse seiner
Tarqui	Atunes De Colombia	80.12	Tuna	Cartagena	Purse seiner
Honduras					
Pampano I	Ramon Elias Vitery	60.00	Tuna	Tumaco	
Japan					
Chiyoda Maru 11	Inpesca	113.58	Tuna	Buenaventura	Longliner
Chiyoda Maru 33	Inpesca	173.40	Tuna	Buenaventura	
Hamashumaru	Copescol	160.13	Tuna	Buenaventura	
Isomae Maru 21	Copescol	240.00	Tuna	Buenaventura	
Yushu Maru 51	Frigopesca	250.00	Tuna	Cartagena	Longliner
Sasano Maru 17	Inpeaca	34.75	Tuna	Buenaventura	
Korea					
Victoria 102	Frigopesca	204.09	Tuna	Cartagena	
Victoria 103	Frigopesca	204.09	Tuna	Cartagena	
Mexico					
Aleta Amarilla	Industrial Pesquera C/Biana	506.80	Tuna	Cartagena	Purse seiner
Aleta Azul	Atunec S.A.	506.82	Tuna	Barranquilla	Purse seiner
Cabo San Lucas	Industral Pesquera C/Biana	466.20	Tuna	Cartagena	Purse seiner
Juliana Marie	Ricapesca	190.68	Tuna	Buenaventura	Purse seiner
Lupe Del Mar	Industral Pesquera C/Biana	506.82	Tuna	Cartagena	Purse seiner
Marinero Otero	Industral Pesquera C/Biana	449.88	Tuna	Cartagena	Purse seiner
New Zealand					
Western Pacific	Coltuna	265.42	Tuna	Buenaventura	Purse seiner
Panama					
Andrea II	Explopesca Ltda.	171.00	Tuna	Cartagena	
Diane Marie	Marcol	152.91	Tuna	Tumaco	Purse seiner
Don Celso	Frigopesca	208.74	Tuna	Cartagena	
Don Esteban	Exploesca	40.99	Tuna/finfish	Cartagena	Combination vessel
Don Sabastian	Explopesca	61.64	Tuna/finfish	Cartagena	Combination vessel
Eileen Marie	Commercial El Delfin Blanco	133.00	Tuna	Tumaco	Purse seiner
Gemenis	Frigomarina	62.00	Tuna	Buenaventura	Purse seiner
Julie L.	Frigogan	586.00	Tuna	Barranquilla	Purse seiner
Pollux II	Explopesca	71.00	Tuna/finfish	Cartagena	Combination vessel
Sun 701	Inpesca	151.84	Tuna	Buenaventura	
Tauro	Copescol	82.00	Tuna	Buenaventura	Purse seiner
Victoria 1*	C.I. Oceanos	171.00	Tuna	Cartagena	
Victoria 8*	Pescaderia Asturiana	150.66	Tuna/finfish	Cartagena	Combination vessel
Victoria A	Copescol	300.47	Tuna	Buenaventura	Longliner
Russia					
Marginela	Frigomarina	283.00	Tuna	Buenaventura	Tibiya class
Mureks	Frigomarina	283.00	Tuna	Buenaventura	Tibiya class

St. Vincent					
Alize	Frigopesca	250.00	Tuna	Cartagena	Purse seiner
Ugavi	Frigopesca	281.00	Tuna	Cartagena	Purse seiner
Spain					
Isabel 5	Copescol	489.74	Tuna	Buenaventura	Purse seiner
Monteclaro	Frigopesca	327.03	Tuna	Cartagena	
Monteneme	Frigopesca	429.71	Tuna	Cartagena	
United States					
Atlantis	Frigogan	585.00	Tuna	Barranquilla	Purse seiner
Bold Aventures	Frigogan	579.00	Tuna	Barranquilla	Purse seiner
Cape San Vincent	Frigogan	301.00	Tuna	Barranquilla	
Captain Vincent Gann	Frigogan	689.00	Tuna	Barranquilla	Purse seiner
Connie Jean	Marisol Del Pacifico	208.00	Tuna	Buenaventura	Purse seiner
Nikolek	Frigogan	351.00	Tuna	Barranquilla	
Pamela Ann	Frigogan	420.00	Tuna	Barranquilla	Purse seiner
South Seas	Frigogan	586.00	Tuna	Barranquilla	Purse seiner
Vanuatu					
Amanda	Atunes De Colombia	450.00	Tuna	Cartagena	Purse siner
Cabo De Hornos	Atunes De Colombia	555.21	Tuna	Cartagena	Purse seiner
El Rey	Atunes De Colombia	450.00	Tuna	Cartagena	Purse seiner
Jane Elizabeth	Frigogan	351.00	Tuna	Barranquilla	Purse seiner
Maria Francisca	Frigopesca	476.01	Tuna	Cartagena	Purse seiner
Marinero	Atunes De Colombia	564.67	Tuna	Cartagena	Purse seiner
Mirelur	Vikingos	503.88	Tuna	Cartagena	Purse seiner
Olimpia	Atunes De Colombia	491.00	Tuna	Cartagena	Purse seiner
Yelisava	Frigogan	302.00	Tuna	Barranquilla	Purse seiner
Sea Royal	Atunes De Colombia	881.72	Tuna	Cartagena	Purse seiner
Tiuna	Atunes De Colombia	598.18	Tuna	Cartagena	Purse seiner
Venezuela					
Ann Mary	Frigogan	87.96	Tuna	Barranquilla	
Canaima	Vikingos	340.34	Tuna	Cartagena	Purse seiner
Don Abel	Frigopesca	391.92	Tuna	Cartagena	Purse seiner
El Rifle	Frigogan	507.80	Tuna	Barranquilla	Purse seiner
Flamarca VII	Atunec S.A.	591.54	Tuna	Barranquilla	Purse seiner
Flamarca VIII	Atunec S.A.	591.54	Tuna	Barranquilla	Purse seiner
Flamarca IX	Atunec S.A.	461.00	Tuna	Barranquilla	
Genisis	Frigopesca	355.92	Tuna	Cartagena	Purse seiner
Jane	Frigopesca	595.00	Tuna	Cartagena	Purse seiner
Jenny Margot	Frigogan	544.58	Tuna	Cartagena	Purse seiner
La Foca	Frigogan	595.00	Tuna	Barranquilla	Purse seiner
La Parrula	Frigopesca	368.10	Tuna	Cartagena	Purse seiner
Los Roques	Frigogan	395.28	Tuna	Barranquilla	Purse seiner
Lucile	Frigopesca	367.36	Tuna	Cartagena	Purse seiner
Napoleon	Frigopesca	786.00	Tuna	Cartagena	Purse seiner
Orinoco	Vikingos	394.50	Tuna	Cartagena	Purse seiner
Pacifico's	Frigogan	395.28	Tuna	Barranquilla	

* One local observer indicates that these may be the same vessel, after a change in the name. The differing size is unexplained.
Source: INPA

Appendix A5c.--Colombia. Licensed fishing vessels, by company, 1995

Company/ Vessel	Vessel size NRT	Country	Target species	Port
Atunec S.A.				
Aleta Azul	506.82	Mexico	Tuna	Barranquilla
Don Quijote	170.80	Ecuador	Tuna	Barranquilla
Flamarca VII	591.54	Venezuela	Tuna	Barranquilla
Flamarca VIII	591.54	Venezuela	Tuna	Barranquilla
Flamarca IX	461.00	Venezuela	Tuna	Barranquilla
Jacques Cartier	376.09	Ecuador	Tuna	Barranquilla
Jambeli	157.71	Ecuador	Tuna	Braranquilla
Lucia T.	354.32	Ecuador	Tuna	Barranquilla
Atunes De Colombia				
Amanda	450.00	Vanuatu	Tuna	Cartagena
America Eagle	459.00	Colombia	Tuna	Cartagena
Cabo De Hornos	555.21	Vanuatu	Tuna	Cartagena
Ciudad de Manta	74.24	Ecuador	Tuna	Cartagena
Dominador	57.17	Ecuador	Tuna	Cartagena
El Dorado	172.30	Colombia	Tuna	Cartagena
El Rey	450.00	Vanuatu	Tuna	Cartagena
Enterprise	594.00	Colombia	Tuna	Cartagena
Grenadier	412.92	Colombia	Tuna	Cartagena
Lucy	80.12	Ecuador	Tuna	Cartagena
Marinero	564.67	Vanuatu	Tuna	Cartagena
Monte Cristi	311.33	Ecuador	Tuna	Cartagena
Olimpia	491.00	Vanuatu	Tuna	Cartagena
Ramoncho	43.22	Ecuador	Tuna	Cartagena
Sandra C.	469.00	Colombia	Tuna	Cartagena
Sea Royal	881.72	Vanuatu	Tuna	Cartagena
Tarqui	80.12	Ecuador	Tuna	Cartagena
Tiuna	598.18	Vanuatu	Tuna	Cartagena
Buitrago Garces (Alvaro)				
Sea Rover	51.00	Colombia	Tuna	Buenaventura
Castrillon, (Carlos Eduardo)				
Eastbound One	132.00	Belize	Tuna/finfish	Tumaco
Commercial El Delfin Blanco				
Eileen Marie	133.00	Panama	Tuna	Tumaco
Rocio	125.02	Colombia	Tuna	Tumaco
C.I. Oceanos				
Victoria 1**	171.00	Panama	Tuna	Cartagena
Coltuna				
Western Pacific	265.42	New Zealand	Tuna	Buenaventura
Copescol				
Adriana	57.26	Ecuador	Tuna	Buenaventura
Ana Maria F.	205.58	Ecuador	Tuna	Buenaventura
Charo	494.00	Belize	Tuna	Buenaventura
Emperador	41.00	Ecuador	Tuna	Buenaventura
Erasmo F.	270.54	Ecuador	Tuna	Buenaventura
Gabriela A.	143.43	Ecuador	Tuna	Buenaventura
Gloria A.	243.00	Ecuador	Tuna	Buenaventura
Hamashumaru	160.13	Japan	Tuna	Buenaventura
Ingalapagos	141.69	Ecuador	Tuna	Buenaventura
Isabel 2	372.60	Ecuador	Tuna	Buenaventura
Isabel 4	372.60	Ecuador	Tuna	Buenaventura
Isabel 5	489.74	Spain	Tuna	Buenaventura
Isabel Tuna	552.96	Cyprus	Tuna	Buenaventura
Isomae Maru no. 21	240.00	Japan	Tuna	Buenaventura
Myriam	101.16	Ecuador	Tuna	Buenaventura
Pancho V	44.16	Ecuador	Tuna	Buenaventura
Roberto A.	143.43	Ecuador	Tuna	Buenaventura
Saturno	34.75	Ecuador	Tuna	Buenaventura
Taganga	27.76	Colombia	Tuna	Buenaventura
Taroa	27.76	Colombia	Tuna	Buenaventura
Tauro	82.00	Panama	Tuna	Buenaventura
Victoria A	300.47	Panama	Tuna	Buenaventura

Copromar				
Adalgiz II	72.00	Belize	Tuna	Cartagena
Gertruz II	72.00	Belize	Tuna	Cartagena
Sabrina	155.53	Belize	Tuna/finfish	Cartagena
Emp. Nat. De Pesca Martima				
El Gringo	55.00	Colombia	Tuna/finfish	Buenaventura
Rebelde	55.00	Colombia	Tuna/finfish	Buenaventura
Explopesca Ltda.				
Andrea II	171.00	Panama	Tuna	Cartagena
Don Esteban	40.99	Panama	Tuna/finfish	Cartagena
Don Sabastian	61.64	Panama	Tuna/finfish	Cartagena
Pollux II	71.00	Panama	Tuna/finfish	Cartagena
Filetes Del Mar & Cia Ltda				
Calipso 82	88.00	Colombia	Tuna	Buenaventura
Frigogan				
Ann Mary	87.96	Venezuela	Tuna	Barranquilla
Atlantis	585.00	USA	Tuna	Barranquilla
Bold Aventures	579.00	USA	Tuna	Barranquilla
Cape San Vincent	301.00	USA	Tuna	Barranquilla
Captain Vincent Gann	689.00	USA	Tuna	Barranquilla
El Rifle	507.80	Venezuela	Tuna	Barranquilla
Jane Elizabeth	351.00	Vanuatu	Tuna	Barranquilla
Julie L.	586.00	Panama	Tuna	Barranquilla
La Foca	595.00	Venezuela	Tuna	Barranquilla
Los Roques	395.28	Venezuela	Tuna	Barranquilla
Nikolek	351.00	United States	Tuna	Barranquilla
Pacifico's	395.28	Venesuela	Tuna	Barranquilla
Pamela Ann	420.00	United States	Tuna	Barranquilla
South Seas	586.00	USA	Tuna	Barranquilla
Yelisava	302.00	Vanuatu	Tuna	Barranquilla
Frigomarina				
Gemenis	62.00	Panama	Tuna	Buenaventura
Marginela	283.00	Russia	Tuna	Buenaventura
Mureks	283.00	Russia	Tuna	Buenaventura
Frigopesca*				
Alize	250.00	St. Vincent	Tuna	Cartagena
Betty Eliabeth	90.60	Ecuador	Tuna	Cartagena
Don Abel	391.92	Venezuela	Tuna	Cartagena
Don Cels	208.74	Panama	Tuna	Cartagena
Fiorella L.	205.58	Ecuador	Tuna	Cartagena
Genisis	355.92	Venezuela	Tuna	Cartagena
Jane	595.00	Venezuela	Tuna	Cartagena
Jenny Margot	544.58	Venezuela	Tuna	Cartagena
La Parrula	368.10	Venezuela	Tuna	Cartagena
Lucile	367.36	Venezuela	Tuna	Cartagena
Maria Francisca	476.01	Vanuatu	Tuna	Cartagena
Monteclaro	327.03	Spain	Tuna	Cartagena
Monteneme	429.71	Spain	Tuna	Cartagena
Napoleon	786.00	Venezuela	Tuna	Cartagena
Ugavi	281.00	St. Vincent	Tuna	Cartagena
Victoria 102	204.09	Korea	Tuna	Cartagena
Victoria 103	204.09	Korea	Tuna	Cartagena
Yushu Maru 51	250.00	Japan	Tuna	Cartagena
Guzman Arias, (Jorge E.)				
Antiqueño	30.62	Colombia	Tuna/finfish	Buenaventura
INPESCA				
Chiyoda Maru 11	113.58	Japan	Tuna	Buenaventura
Chiyoda Maru 33	173.40	Japan	Tuna	Buenaventura
Sasano Maru 17	155.83	Japan	Tuna	Buenaventura
Sun 701	151.84	Panama	Tuna	Buenaventura
Industrial Pesquera C/Biana				
Aleta Amarilla	506.80	Mexico	Tuna	Cartagena
Cabo San Lucas	466.20	Mexico	Tuna	Cartagena
Lupe Del Mar ana	506.82	Mexico	Tuna	Cartagena
Marinero Oteroana	449.88	Mexico	Tuna	Cartagena

Madenar Ltda.				
Don Nacho	66.80	Colombia	Tuna/finfish	Buenaventura
Marcol				
Diane Marie	152.91	Panama	Tuna	Tumaco
Intrepido	42.11	Ecuador	Tuna	Buenaventura
Marisol Del Pacifico				
Connie Jean	208.00	USA	Tuna	Buenaventura
Pescaderia Asturiana				
Victoria 8**	150.66	Panama	Tuna/finfish	Cartagena
Propescol				
Don Antonio	472.00	Colombia	Tuna	Buenaventura
Don Fausto	472.00	Colombia	Tuna	Buenaventura
Ricapesca				
Juliana Marie	190.68	Mexico	Tuna	Buenaventura
Salazar, (Efrain)				
Don Efra	44.00	Colombia	Cas/Tuna	Buenaventura
Vikingos				
Canaima	340.34	Venezuela	Tuna	Cartagena
Mirelur	503.88	Vanuatu	Tuna	Cartagena
Orinoco	394.50	Venezuela	Tuna	Cartagena
Vitery, (Ramon Elias)				
Pampano I	60.00	Honduras	Tuna	Tumaco

* Frigopesca is now part of Vikingos
** One local observer indicates that these may be the same vessels, after name changes. The differing size is unexplained.
Source: INPA

Appendix A6a.--Colombia. Licensed fishing vessels, Caribbean, 1996

Vessel	Company	Fisheries	Country	Port	Size		Length	Hull Material
					NRT	GRT Tons	Meters	
Acandi	Salustiano González	Med. Pel-Dem.	Colombia	Cartagena	3.18	12.58	14.08	Fiberglass
Ann Mary	Unaffiliated	Tuna	Venezuela	Cartagena	87.96	198.95	32.64	Steel
Arboletes	Precoop. El Cardumen	PB	Colombia	Cartagena	3.18	12.58	14.08	Fiberglass
Atlantis	Frigogan S.A.	Tuna	U.S.A.	Cartagena	585.00	1,167.00	61.16	Steel
Baru	Coopesan	Med. Pel-Dem.	Colombia	Cartagena	3.18	12.58	14.08	Fiberglass
Betty C	Frigogan S.A.	Tuna	Belize	Cartagena	396.00	758.64	55.17	Steel
Betty Elizabeth	C.I. Frigopesca	Tuna	Ecuador	Cartagena	90.60	403.98	34.00	Steel
Calypso	C.I. Vikingos S.A.	Tuna	Venezuela	Cartagena	387.15	990.25	65.85	Steel
Canaima	Supertuna S.A.	Tuna	Venezuela	Cartagena	340.34	913.00	34.19	Steel
Capitan Bodden	C.I. Antillana	Dem-Lob	Honduras	Cartagena	37.00	123.00	28.30	Steel
Capitan Dowie	C.I. Antillana	Dem-Lob	Honduras	San Andrés	76.00	110.25	22.00	Steel
Capitan Pecas	Indupesca	Demersals	Honduras	San Andrés	66.00	97.00	20.42	Steel
Capitan Vincent Gann	Frigogan S.A.	Tuna	U.S.A.	Cartagena	689.00	1,387.00	68.97	Steel
Caribana	Coopesan	Med. Pel-Dem.	Colombia	Cartagena	3.18	12.58	14.08	Fiberglass
Carirubana	C.I. Vikingos S.A.	Tuna	Venezuela	Cartagena	386.12	973.30	65.85	Steel
Cartagenita	Francisco Ramos	Med. Pel-Dem.	Colombia	Cartagena	4.00	5.41	9.70	Iron
Cayude	C.I. Vikingos S.A.	Tuna	Venezuela	Cartagena	393.27	958.28	62.70	Steel
Chances R	Pesqueria Rio Grande	Med. Pel-Dem.	U.S.A.	Cartagena	23.00	28.00	14.50	Fiberglass
Ciclon	C.I. Vikingos S.A.	Med. Pel-Dem.	Venezuela	Cartagena	33.46	74.35	17.16	Steel
Dominador	Atuncol S.A.	Tuna	Ecuador	Cartagena	57.17	175.00	25.78	Steel
Don Abel	C.I. Frigopesca	Tuna	Venezuela	Cartagena	391.92	1,027.88	62.75	Steel
Don Bartolo	Frigogan S.A,	Tuna	Belize	Cartagena	242.00	606.00	50.29	Steel
Dulce	C.I. Vikingos de Col.	Med. Pel-Dem.	Venezuela	Cartagena	51.16	128.67	23.30	Steel
El Navegante	C.I. Vikingos de Col.	Med. Pel-Dem.	Venezuela	Cartagena	34.04	292.05	38.30	Steel
Falkon	C.I. Vikingos S.A.	Tuna	Venezuela	Cartagena	382.12	973.30	65.85	Steel
Fiorella	C.I. Frigopesca	Tuna	Ecuador	Cartagena	205.58	612.41	39.46	Steel
Genesis	C.I. Frigopesca	Tuna	Venezuela	Cartagena	260.00	771.82	17.85	Steel
Harry Truman	Inveramarp Ltda.	Demersals	Colombia	Cartagena	14.00	23.00	19.00	Steel
High Hopes	Gonzalo Howard	Demersals	Colombia	San Andrés	13.00	18.00	12.00	Fiberglass
Jane	Frigogan S.A.	Tuna	Venezuela	Cartagena	392.56	1,091.28	68.29	Steel
Jenny Margoth II	C.I. Frigopesca	Tuna	Venezuela	Cartagena	544.00	1,815.26	69.02	Steel
Julie L	Frigogan S.A.	Tuna	Panama	Cartagena	596.00	1,516.20	67.52	Steel
La Foca	Frigogan S.A.	Tuna	Venezuela	Cartagena	392.50	1,091.00	68.29	Steel
Lucy	Atuncol S.A.	Tuna	Ecuador	Cartagena	80.12	355.12	31.80	Steel
Luisa A	Centropez	Med. Pel-Dem.	Colombia	San Andrés	28.00	79.84	18.83	Steel
Luisa Maria	Pescar Ltda.	Demersals	Colombia	Cartagena	3.00	5.00	8.00	Wood
Mariano Otero	C.I. Vikingos S.A.	Tuna	Mexico	Cartagena	398.40	1,056.30	70.00	Steel
Miry Ann D	Frigogan S.A.	Tuna	Ecuador	Cartagena	175.55	585.17	50.04	Steel
Miss Catherine V	Indupesca Ltda.	Demersals	Honduras	San Andrés	60.00	100.00	20.72	Steel
Miss Lina	Gonzalo Howard	Demersals	Colombia	San Andrés	22.12	27.30	13.50	Fiberglass
Miss Tina	Indupesca Ltda.	Demersals	Colombia	San Andrés	46.44	69.66	15.21	Steel
Monte Carlo	C.I. Antillana	Med. Pel-Dem.	Colombia	Cartagena	56.11	107.65	21.85	Iron

Montecristi	Atuncol S.A.	Tuna	Ecuador	Cartagena	311.30	601.20	39.94	Steel
Napoleón	Unaffiliated	Tuna	Venezuela	Cartagena	382.55	1,215.17	62.95	Steel
Orinoco II	Supertuna S.A.	Tuna	Venezuela	Cartagena	591.00	1,314.00	58.86	Steel
Pamela Ann	Frigogan S.A.	Tuna	Vanuatu	Cartagena	420.00	914.71	56.91	Steel
Pescamar I	Mar Pesca del Caribe	Demersals	Venezuela	Cartagena	6.50	11.95	12.00	Wood
Promarca II	C.I. Vikingos de Col.	Med. Pel-Dem.	Venezuela	Cartagena	47.06	104.58	21.00	Steel
Quitasueños	Rafaeol Berrio	Med. Pel-Dem.	Colombia	Cartagena	3.18	12.58	14.08	Fiberglass
Roncador	Tesalia Marina Ltda.	Med. Pel-Dem.	Colombia	Cartagena	3.18	12.58	14.08	Fiberglass
San Antero	Precoop. El Cardumen	PB	Colombia	Cartagena	3.18	12.58	14.08	Fiberglass
San Bernardo	Asomcaribe	Med. Pel-Dem.	Colombia	Cartagena	3.18	14.25	14.08	Fiberglass
San Blas	Invemar Ltda.	Demersals	Panama	Buenaventura	7.86	9.83	10.31	Wood
San Lorenzo	C.I. Vikingos S.A.	Tuna	Ecuador	Cartagena	76.74	246.25	36.87	Steel
Santa Catalina	Wilfrido Zúñiga	Med. Pel-Dem.	Colombia	Cartagena	3.18	12.58	14.08	Fiberglass
Sea Diver II	C.I. Antillana S.A.	Med. Pel-Dem.	Honduras	San Andrés	27.00	33.00	15.00	Steel
Sea Gem	Atuncol S.A.	Tuna	Vanuatu	Cartagena	489.00	1,078.00	223.50	Steel
Sea Royal	Atunes de Colombia	Tuna	Vanuatu	Cartagena	881.72	1,820.50	230.63	Steel
Sharon	Pesquera Sharon	Med. Pel-Dem.	Colombia	San Andrés	35.00	45.00	15.50	Iron
Shawn Boy	C.I. Coapesca Ltda.	Med. Pel-Dem.	Colombia	Cartagena	26.00	34.00	14.63	Steel
South Seas	Frigogan S.A.	Tuna	U.S.A.	Cartagena	60.00	89.00	23.30	Steel
Tarqui	Atuncol S.A.	Tuna	Ecuador	Cartagena	80.12	355.12	31.80	Steel
Taurus I	Frigogan S.A.	Tuna	Venezuela	Cartagena	507.60	1,053.67	59.86	Steel
Tiuna	Atuncol S.A.	Tuna	Vanuatu	Cartagena	598.18	1,329.18	221.42	Steel
Triunfo	Elias Ramírez	Dermersals	Colombia	Cartagena	17.52	25.97	14.70	Wood
Valentina	Gonzalo Howard	Demersals	Colombia	San Andrés	23.49	52.39	18.00	Fiberglass
Victor 8	C.I. Asturiana	Tuna	Panama	Cartagena	151.78	299.54	43.63	Steel
Victoria 102	Frigopesca S.A.	Squid	S. Korea	Cartagena	204.09	394.78	47.30	Steel
Western Pacific	Supertuna S.A.	Tuna	Ecuador	Barranquilla	98.76	322.54	36.93	Steel
Yelisava	Frigogan S.A.	Tuna	Vanuatu	Cartagena	NA	606.00	50.38	Steel
Yushu Maru 51	C.I. Frigopesca	Tuna	Japan	Cartagena	250.00	349.00	44.13	Steel

Dem - Demersals
Med. Pel. - Medium pelagics
Lob - Lobsters
Source: Instituto Nacional de Pesca, personal communications, April 16, 1997.

Appendix A6b.--Colombia. Licensed fishing vessels, Pacific, 1996

Vessel	Company	Fisheries	Country	Port	Size		Length	Hull Material
					NRT	GRT		
					Tons		Meters	
Adalgiz II	Rafael Montes	Med. Pel-Dem.	Belize	Buenaventura	72.00	205.00	35.00	Steel
Adriana	C.I. Cimar S.A.	Tuna	Ecuador	Buenaventura	57.26	135.83	25.07	Steel
Adriana	Humberto Tello	Demersals	Colombia	Buenaventura	16.00	38.58	17.00	Wood
Adriana del Pilar	William May Carrillo	CAS	Colombia	Buenaventura	50.00	106.37	22.83	Steel
Amanda	Atuncol S.A.	Tuna	Vanuatu	Cartagena	460.00	1,535.00	66.20	Steel
Amazonas	Supertuna S.A.	Tuna	Venezuela	Cartagena	461.00	916.20	65.30	Steel
American Eagle	Atuncol S.A.	Tuna	Colombia	Cartagena	469.00	990.00	59.87	Steel
Antioqueño	Jorge E. Guzman	Med. Pel-Dem.*	Colombia	Buenaventura	30.62	45.03	14.81	Iron
Atila	José A. Henao Y Cia.	Small Pelagics	Colombia	Buenaventura	23.00	34.76	14.94	Iron
Aurora	Manuel A. Satizabal	Demersals	Colombia	Buenaventura	25.00	51.25	17.05	Wood
Bahía	Félix Isaac Torres	Med. Pel-Dem.	Colombia	Buenaventura	25.00	38.32	17.90	Wood
Balbina	Cimar S.A.	Tuna	Ecuador	Buenaventura	76.70	145.20	30.17	Steel
Bocana 1	Javier Valencia	Med. Pel-Dem.	Colombia	Buenaventura	45.00	NA	NA	Iron
Bold Adventures	Frigogan S.A.	Tuna	U.S.A.	Cartagena	579.00	1,930.00	68.97	Steel
Britanic	Gustavo R. Salas	Med. Pel-Dem.	Colombia	Buenaventura	47.00	75.53	21.00	Wood
Cabo de Hornos	Atuncol S.A.	Tuna	Vanuatu	Cartagena	257.20	850.00	55.60	Steel
Carlos Benjamín	José A. Henao Y Cia.	Small Pelagics	Ecuador	Buenaventura	30.05	109.66	21.32	Steel
Carmelo	Isabel R. De Realpe	Demersals	Colombia	Buenaventura	35.00	100.10	18.60	Wood
Caroni	Atunec S.A.	Tuna	Venezuela	Cartagena	313.80	916.40	65.30	Steel
Chidori Maru 21	Agropes. Bahia Cupica	Tuna	Japan	Buenaventura	241.00	379.00	49.39	Steel
Chiyoda Maru 11	Bahia Cupica	Tuna	Japan	Buenaventura	113.58	252.95	40.59	Steel
Ciclón	C.I. Vikingos	Med. Pel-Dem.	Venezuela	Cartagena	33.46	74.35	7.16	Steel
Ciudad de Manta	C.I. Cimar S.A.	Tuna	Ecuador	Buenaventura	74.24	210.45	30.90	Steel
Cocoliso	Agropes. Bahia Cupica	Med. Pel-Dem.*	Colombia	Buenaventura	22.10	55.80	19.50	Steel
Copespa II	Inpesca S.A.	Pec. ZEE	Colombia	Buenaventura	39.90	92.98	21.96	Steel
Copespa IV	Adolfo Aragón	Med. Pel-Dem.*	Colombia	Buenaventura	39.90	92.98	21.96	Iron
Danubio	Federico Estupiñan	PB	Colombia	Buenaventura	29.00	39.22	20.45	Wood
Dario Andrés	Inversiones Echeverry	Tuna/Demersals	Colombia	Tumaco	133.00	446.00	39.52	Steel
Davys Lane	Camilo Ochoa Moreno	Med. Pel-Dem.	Colombia	Buenaventura	45.00	108.00	30.00	Steel
Delfín III	Esteban R. Salas	Med. Pel-Dem.	Colombia	Buenaventura	25.05	52.00	16.00	Wood
Don Adolfo	Jaime E. Pineda	Med. Pel-Dem.	Colombia	Buenaventura	9.20	24.00	11.00	Wood
Doña Rosa I	Jorge E. Arango	Med. Pel-Dem.	Colombia	Buenaventura	63.00	122.01	24.42	Wood
Domingo	José A. Henao y Cia.	Small Pelagics	Colombia	Buenaventura	36.00	147.60	22.00	Iron
Don Antonio	Propescol	Tuna	Colombia	Buenaventura	472.00	876.00	55.25	Steel
Don Celso	Arpecol	Tuna	Ecuador	Buenaventura	208.78	695.80	47.90	Steel
Don Fausto	Propescol	Tuna	Colombia	Buenaventura	472.00	876.50	55.24	Steel
Don Marcos I	Rosa Helena Garces	Med. Pel-Dem.	Colombia	Buenaventura	25.00	44.17	16.00	Wood
Don Nacho	Mad y Mariscos Nare	Med. Pel-Dem.	Colombia	Buenaventura	63.89	122.01	24.42	Wood
Douglas I	Marco Aurelio Loaiza	Med. Pel-Dem.	Colombia	Tumaco	87.00	127.00	20.90	Fiberglass
Eileen Marie	Com. Delfin Blanco	Tuna	Colombia	Tumaco	133.00	485.00	34.87	Steel
Emire	Féliz Issac Torres	Demersals	Colombia	Buenaventura	9.00	15.76	13.50	Wood
Pelkin	Rafael Obando Torres	Demersals	Colombia	Buenaventura	43.76	76.05	20.52	Iron
El Arriero	José A. Henao y Cia.	Small Pelagics	Colombia	Buenaventura	41.00	97.89	21.90	Steel
El Coral	Luz H. Mosquera	Med. Pel-Dem.	Colombia	Buenaventura	51.43	74.03	23.00	Steel
El Martín	Gabriel Vanegas	Med. Pel-Dem.	Honduras	Buenaventura	17.25	69.01	19.50	Steel
El Llanero	Marina Díaz Maury	Med. Pel-Dem.	Colombia	Buenaventura	15.00	42.21	17.70	Wood

Enterprise	Atuncol S.A.	Tuna	Colombia	Cartagena	594.00	1,159.92	61.21	Steel
Faraón V	Miguel C. Naranjo	Med. Pel-Dem.	Colombia	Buenaventura	33.25	102.35	22.20	Iron
Fénix	Higinio R. Salas	Demersals	Colombia	Buenaventura	39.49	59.51	20.03	Wood
Géminis	Frigo. Marina Ltda.	Tuna	Panama	Buenaventura	82.00	244.00	32.01	Steel
Géminis Star 8	Cirilo Olaya Riascos	Med. Pel-Dem.	Colombia	Buenaventura	29.00	37.70	15.21	Wood
Génesis	C.I. Frigopesca S.A.	Tuna	Venezuela	Cartagena	260.00	673.77	47.85	Steel
Gold Coast	Atunes de Colombia	Tuna	Vanuatu	Cartagena	504.17	1,428.24	69.89	Steel
Grenadier	Atuncol S.A.	Tuna	Cartagena	Colombia	412.92	1,183.94	59.86	Steel
Hua Yuan Yu 9	Copesnar	Tuna	China	Tumaco	69.00	198.00	31.30	Steel
Hua Yuan Yu 10	Copesnar	Tuna	China	Tumaco	69.00	198.00	31.30	Steel
Huayaipe	Dispa Ltda.	Med. Pel-Dem.*	Ecuador	Buenaventura	56.10	116.70	22.63	Steel
Ingalápagos	S.C.A. Coltuna Ltda.	Tuna	Ecuador	Buenaventura	141.69	341.89	33.87	Steel
Investigador	José A. Henao y Cia.	Small Pelagics	Colombia	Buenaventura	12.00	41.00	15.10	Steel
Isabela	Adolfo Aragón	Tuna	Colombia	Buenaventura	41.00	118.89	21.96	Steel
Isla de la Plata	Florencia M. Estupiñan	Med. Pel-Dem.	Colombia	Buenaventura	18.00	24.56	13.30	Wood
Islamar	Zully Narváez Reina	Med. Pel-Dem.	Colombia	Tumaco	14.00	28.00	19.62	Wood
J.H.A.	José A. Henao y Cia.	Small Pelagics	Colombia	Buenaventura	34.80	135.70	21.00	Steel
Jhon Henry	Reynaldo C. Caicedo	Demersals	Colombia	Buenaventura	16.28	45.70	16.27	Wood
Joma	Joel Estupiñan	Demersals	Colombia	Buenaventura	22.00	44.09	15.80	Wood
Juliana	Iván Hernández Castro	Tuna	Belize	Buenaventura	74.16	180.00	24.39	Steel
Kathiuska Kellu	Nelson A. Reina	Med. Pel-Dem.*	Panama	Buenaventura	47.00	158.00	27.43	Steel
La Mano Amiga	Roberto Cuero Caicedo	Med. Pel-Dem.	Colombia	Tumaco	9.25	17.69	11.33	Iron
Liliana II	Maria M. Asprilla	Med. Pel-Dem.	Colombia	Buenaventura	27.00	43.70	19.00	Iron
Long Line I	Ramón Elias Vitery	Demersals	Honduras	Tumaco	64.00	95.00	26.50	Steel
Lut Janus	José V. Narváez Polo	Med. Pel-Dem.	Panama	Buenavenura	82.37	103.00	NA	Steel
Mister Jack	Simsa y Cia. Ltda.	Demersals	Colombia	Buenaventura	65.19	84.54	20.42	Iron
Mako	Eduardo A. Salazar	Med. Pel-Dem.	Colombia	Tumaco	17.04	44.10	15.40	Wood
María	C.I. Cimar Ltda.	Tuna	Ecuador	Buenaventura	62.52	264.83	31.75	Steel
María Fátima	Cimar S.A.	Tuna	Ecuador	Buenaventura	119.45	398.18	32.40	Steel
Marisela	Oscar T. Martan	Dem-Tuna	Panama	Buenaventura	73.08	107.00	19.81	Steel
Marsella	Julio Portocarrero	Demersals	Colombia	Tumaco	43.12	65.38	19.30	Wood
Melba Patricia	Proteimar Ltda.	Small Pelagics	Colombia	Tumaco	89.12	199.79	27.65	Steel
Melissa	Pedro L. Reina	PB	Colombia	Buenaventura	19.30	40.00	19.75	Wood
Meta	Mauricio A. Gómez	Med. Pel-Dem.	Colombia	Buenaventura	34.92	84.70	19.36	Steel
Montecarlo	Inversiones Micolta H.	Med. Pel-Dem.*	Colombia	Buenaventura	56.11	107.69	21.85	Steel
Mr. Robin	Pedro Leonidas Reina	PB	Colombia	Buenaventura	24.56	64.33	18.62	Wood
Mr. Juan	Rubén Dario Cuevas	Demersals	Belize	Buenaventura	74.14	92.68	21.09	Steel
Octopus	Pedro Portocarrero	Med. Pel-Dem.	Honduras	Buenaventura	66.00	98.00	33.50	Steel
OFI	Otoniel Castillo	Tuna	Colombia	Buenaventura	19.79	64.55	20.73	Wood
Orca IV	Arnold Libreros	Demersals	Colombia	Buenaventura	7.30	19.40	10.70	Fiberglass
Oriana	Federico Estupiñan	Med. Pel-Dem.	Colombia	Buenaventura	23.00	28.02	13.00	Wood
Patria	Julio Portocarreros	Demersals	Colombia	Buenaventura	NA	NA	18.00	Steel
Patricia Lynn	Agrop. Bahia Cupica	Tuna	Panama	Buenaventura	188.00	277.00	32.95	Steel
Petter	Pedro P. Portocarrero	Med. Pel-Dem.	Colombia	Buenaventura	18.00	40.00	18.40	Wood
Pilgrim	Carlos E. Castrillón	Med. Pel-Dem.*	Belize	Tumaco	132.00	194.00	42.07	Iron
Popeye	Invermarp Ltda.	Demersals	U.S.A.	Buenaventura	40.00	59.00	18.30	Wood
Queen Susana	Andrés Paredes Salas	Med. Pel-Dem.	Colombia	Buenaventura	31.04	79.60	21.33	Wood
Priscomar	Abraham Torres	Demersals	Colombia	Buenaventura	33.85	47.60	19.00	Wood
Ramoncho	C.I. Cimar S.A.	Tuna	Ecuador	Buenaventura	43.22	159.39	27.35	Steel

Rocio del Pilar	Com. el Delfin Blanco	Tuna	Colombia	Buenaventura	125.02	224.60	29.02	Steel
Romeo	C.I. Cimar S.A.	Tuna	Ecuador	Buenaventura	44.16	132.00	24.08	Steel
Samanda	Proteimar Ltda.	Small Pelagics	Colombia	Tumaco	57.88	127.30	23.36	Steel
San Antonio V	Cimar S.A.	Tuna	Ecuador	Buenaventura	78.25	395.19	31.55	Steel
San Blás	Invermarp Ltda.	Demersals	Panama	Buenaventura	7.86	9.83	10.31	Steel
Saturno	C.I. Cimar Ltda.	Tuna	Ecuador	Buenaventura	34.35	163.89	26.46	Wood
Sea Rover	Alvaro G. Buitrago	Tuna	Colombia	Tumaco	51.00	159.60	81.80	Steel
Shoei Maru 28	Agrop. Bahia Cupica	Tuna	Japan	Buenaventura	205.60	379.00	48.03	Steel
Southern Explorer	Cimar S.A.	Tuna	Ecuador	Buenaventura	86.39	188.95	29.80	Wood
Southern Queen	C.I. Cimar S.A.	Tuna	Ecuador	Buenaventura	103.00	199.00	30.60	Steel
Tango	Víctor Solís	Med. Pel-Dem.	Colombia	Buenaventura	6.51	8.51	15.56	Wood
Tauro	Frigomarina Ltda.	Tuna	Panama	Buenaventura	62.00	246.00	32.01	Steel
Ugavi	C.I. Frigopesca	Tuna	Colombia	Cartagena	281.00	1,509.00	69.00	Steel
Wilcy	Wilson Vera Castro	Med. Pel-Dem.	Colombia	Buenaventura	26.50	87.74	20.42	Steel
Yelisava	Frigogan S.A.	Tuna	Vanuatu	Cartagena	302.00	606.00	50.09	Steel
Yemaya	Walter Cortés Cortés	Med. Pel-Dem.	Colombia	Buenaventura	41.00	113.60	23.80	Iron

* Unidentified category
** These vessels also target tuna seasonally
Dem: Demersals
Med. Pel: Medium Pelagics
PB: Pesca Blanca (various "white fish/flesh" species)
Source: Instituto Nacional de Pesca, personal communications, April 16, 1997.

Appendix A6c.--Colombia. Licensed tuna vessels, by country 1996

Country/ vessel	Company	Fisheries	Port	Size		Length	Hull Material	Vessel Type
				NRT	GRT			
				Tons		Meters		
Belize								
Betty C	Frigogan S.A.	Tuna	Cartagena	396.00	758.64	55.17	Steel	Purse seiner
Don Bartolo	Frigogan S.A,	Tuna	Cartagena	242.00	606.00	50.29	Steel	Purse seiner
Juliana	Iván Hernández Castro	Tuna	Buenaventura	74.16	180.00	24.39	Steel	
Pilgrim	Carlos E. Castrillón	Tuna/finfish*	Tumaco	132.00	194.00	42.07	Iron	Combination
China								
Hua Yuan Yu 9	Copesnar	Tuna	Tumaco	69.00	198.00	31.30	Steel	Longliner?
Hua Yuan Yu 10	Copesnar	Tuna	Tumaco	69.00	198.00	31.30	Steel	Longliner?
Colombia								
American Eagle	Atuncol S.A.	Tuna	Cartagena	469.00	990.00	59.87	Steel	Purse seiner
Antioqueño	Jorge E. Guzman	Tuna/finfish*	Buenaventura	30.62	45.03	14.81	Iron	Combination vessel
Cocoliso	Bahia Cupica	Tuna/finfish*	Buenaventura	22.10	55.80	19.50	Steel	Combination vessel
Copespa IV	Adolfo Aragón	Tuna/finfish*	Buenaventura	39.90	92.98	21.96	Iron	Combination vessel
Dario Andrés	Inversiones Echeverry	Tuna/Demersals	Tumaco	133.00	446.00	39.52	Steel	Combination vessel
Don Antonio	Propescol	Tuna	Buenaventura	472.00	876.00	55.25	Steel	Purse seiner
Don Fausto	Propescol	Tuna	Buenaventura	472.00	876.50	55.24	Steel	Purse seiner
Eileen Marie	Com. El Delfin Blanco	Tuna	Tumaco	133.00	485.00	34.87	Steel	Purse seinerr
Enterprise	Atuncol S.A.	Tuna	Cartagena	594.00	1,159.92	61.21	Steel	Purse seiner
Grenadier	Atuncol S.A.	Tuna	Cartagena	412.92	1,183.94	59.86	Steel	Purse seiner
Isabela	Adolfo Aragón	Tuna	Buenaventura	41.00	118.89	21.96	Steel	Purse seiner
Montecarlo	Inversiones Micolta H.	Tuna/finfish*	Buenaventura	56.11	107.69	21.85	Steel	Combination vessel
OFI	Otoniel Castillo	Tuna	Buenaventura	19.79	64.55	20.73	Wood	
Rocio del Pilar	Com. El Delfin Blanco	Tuna	Buenaventura	125.02	224.60	29.02	Steel	Purse seiner
Sea Rover	Alvaro G. Buitrago	Tuna	Tumaco	51.00	159.60	81.80	Steel	Purse seiner
Ugavi	C.I. Frigopesca	Tuna	Cartagena	281.00	1,509.00	69.00	Steel	Purse seiner
Ecuador								
Adriana	C.I. Cimar S.A.	Tuna	Buenaventura	57.26	135.83	25.07	Steel	Purse seiner
Balbina	C.I. Cimar S.A.	Tuna	Buenaventura	76.70	145.20	30.17	Steel	Purse seiner
Betty Elizabeth	C.I. Frigopesca	Tuna	Cartagena	90.60	403.98	34.00	Steel	Purse seiner
Ciudad de Manta	C.I. Cimar S.A.	Tuna	Buenaventura	74.24	210.45	3.90	Steel	Purse seiner
Dominador	Atuncol S.A.	Tuna	Cartagena	57.17	175.00	25.78	Steel	Purse seiner
Don Celso	Arpecol	Tuna	Buenaventura	208.78	695.80	47.90	Steel	
Fiorella	C.I. Frigopesca	Tuna	Cartagena	205.58	612.41	39.46	Steel	Purse seiner
Huayaipe	Dispa Ltda.	Tuna/finfish*	Buenaventura	56.10	116.70	22.63	Steel	Combination vessel
Ingalápagos	S.C.A. Coltuna Ltda.	Tuna	Buenaventura	141.69	341.89	33.87	Steel	Purse seiner
Lucy	Atuncol S.A.	Tuna	Cartagena	80.12	355.12	31.80	Steel	Purse seiner
María	C.I. Cimar S.A.	Tuna	Buenaventura	62.52	264.83	31.75	Steel	Purse seiner
María Fátima	C.I. Cimar S.A.	Tuna	Buenaventura	119.45	398.18	32.40	Steel	Purse seiner
Miry Ann D	Frigogan S.A.	Tuna	Cartagena	175.55	585.17	50.04	Steel	Purse seiner
Montecristi	Atuncol S.A.	Tuna	Cartagena	311.30	601.20	39.94	Steel	Purse seiner
Ramoncho	C.I. Cimar S.A.	Tuna	Buenaventura	43.22	159.39	27.35	Steel	Purse seiner
Romeo	C.I. Cimar S.A.	Tuna	Buenaventura	44.16	132.00	24.08	Steel	Purse seiner

San Antonio V	C.I. Cimar S.A.	Tuna	Buenaventura	78.25	395.19	31.55	Steel	Purse seiner
San Lorenzo	C.I. Vikingos S.A.	Tuna	Cartagena	76.74	246.25	36.87	Steel	
Saturno	C.I. Cimar S.A.	Tuna	Buenaventura	34.35	163.89	26.46	Wood	Purse cseiner
Southern Explorer	C.I. Cimar S.A.	Tuna	Buenaventura	86.39	188.95	29.80	Wood	Purse seiner
Southern Queen	C.I. Cimar S.A.	Tuna	Buenaventura	103.00	199.00	30.60	Steel	Purse seiner
Tarqui	Atuncol S.A.	Tuna	Cartagena	80.12	355.12	31.80	Steel	Purse seiner
Western Pacific	Supertuna S.A.	Tuna	Barranquilla	98.76	322.54	36.93	Steel	Purse seiner
Japan								
Chidori Maru 21	Bahia Cupica	Tuna	Buenaventura	241.00	379.00	49.39	Steel	
Chiyoda Maru 11	Bahia Cupica	Tuna	Buenaventura	113.58	252.95	40.59	Steel	Longliner
Shoei Maru 28	Bahia Cupica	Tuna	Buenaventura	205.60	379.00	48.03	Steel	
Yushu Maru 51	C.I. Frigopesca	Tuna	Cartagena	250.00	349.00	44.13	Steel	Longliner
Mexico								
Mariano Otero	C.I. Vikingos S.A.	Tuna	Cartagena	398.40	1,056.30	70.00	Steel	Purse seiner
Panama								
Géminis	Frigomarina Ltda.	Tuna	Buenaventura	82.00	244.00	32.01	Steel	Purse seiner
Julie L	Frigogan S.A.	Tuna	Cartagena	596.00	1,516.20	67.52	Steel	Purse seiner
Kathiuska Kellu	Nelson A. Reina	Tuna/finfish*	Buenaventura	47.00	158.00	27.43	Steel	Combination vessel
Marisela	Oscar T. Martan	Tuna/Demersal	Buenaventura	73.08	107.00	19.81	Steel	Combination vessel
Patricia Lynn	Bahia Cupica	Tuna	Buenaventura	188.00	277.00	32.95	Steel	Purse seiner
Pilgrim	Carlos E. Castrillón	Tuna/finfish*	Tumaco	132.00	194.00	42.07	Iron	Combination vessel
Tauro	Frigomarina Ltda.	Tuna	Buenaventura	62.00	246.00	32.01	Steel	Purse seiner
Victoria 8	C.I. Asturiana	Tuna	Cartagena	151.78	299.54	43.63	Steel	Longliner
United States								
Atlantis	Frigogan S.A.	Tuna	Cartagena	585.00	1,167.00	61.16	Steel	Purse seiner
Bold Adventures	Frigogan S.A.	Tuna	Cartagena	579.00	1,930.00	68.97	Steel	Purse seiner
Capitan Vincent Gann	Frigogan S.A.	Tuna	Cartagena	689.00	1,387.00	68.97	Steel	Purse seiner
South Seas	Frigogan S.A.	Tuna	Cartagena	60.00	89.00	23.30	Steel	Purse seiner
Vanuatu								
Amanda	Atuncol S.A.	Tuna	Cartagena	460.00	1,535.00	66.20	Steel	Purse seiner
Cabo de Hornos	Atuncol S.A.	Tuna	Cartagena	257.20	850.00	55.60	Steel	Purse seiner
Gold Coast	Atunes de Colombia	Tuna	Cartagena	504.17	1,428.24	69.89	Steel	Purse seiner
Pamela Ann	Frigogan S.A.	Tuna	Cartagena	420.00	914.71	56.91	Steel	Purse seiner
Sea Gem	Atuncol S.A.	Tuna	Cartagena	489.00	1,078.00	223.50	Steel	
Sea Royal	Atunes de Colombia	Tuna	Cartagena	881.72	1,820.50	230.63	Steel	Purse seiner
Tiuna	Atuncol S.A.	Tuna	Cartagena	598.18	1,329.18	221.42	Steel	Purse seiner
Yelisava	Frigogan S.A.	Tuna	Cartagena	302.00	606.00	50.09	Steel	Purse seiner
Venezuela								
Amazonas	Supertuna S.A.	Tuna	Cartagena	461.00	916.20	65.30	Steel	Purse seiner
Ann Mary	Unaffiliated	Tuna	Cartagena	87.96	198.95	32.64	Steel	
Calypso	C.I. Vikingos S.A.	Tuna	Cartagena	387.15	990.25	65.85	Steel	Purse seiner
Canaima	Supertuna S.A.	Tuna	Cartagena	340.34	913.00	34.19	Steel	Purse seiner

Carirubana	C.I. Vikingos S.A.	Tuna	Cartagena	386.12	973.30	65.85	Steel	Purse seiner
Caroni	Atunec S.A.	Tuna	Cartagena	313.80	916.40	65.30	Steel	Purse seiner
Cayude	C.I. Vikingos S.A.	Tuna	Cartagena	393.27	958.28	62.70	Steel	Purse seiner
Don Abel	C.I. Frigopesca	Tuna	Cartagena	391.92	1,027.88	62.75	Steel	Purse seiner
Falcón	C.I. Vikingos S.A.	Tuna	Cartagena	382.12	973.30	65.85	Steel	Purse seiner
Génesis**	C.I. Frigopesca	Tuna	Cartagena	260.00	771.82	17.85	Steel	Purse seiner
Génesis**	C.I. Frigopesca	Tuna	Cartagena	260.00	673.77	47.85	Steel	Purse seiner
Jane	Frigogan S.A.	Tuna	Cartagena	392.56	1,091.28	68.29	Steel	Purse seiner
Jenny Margoth II	C.I. Frigopesca	Tuna	Cartagena	544.00	1,815.26	69.02	Steel	Purse seiner
La Foca	Frigogan S.A.	Tuna	Cartagena	392.50	1,091.00	68.29	Steel	Purse seiner
Napoleón	Unaffiliated	Tuna	Cartagena	382.55	1,215.17	62.95	Steel	Purse seiner
Orinoco II	Supertuna S.A.	Tuna	Cartagena	591.00	1,314.00	58.86	Steel	Purse seiner
Taurus I	Frigogan S.A.	Tuna	Cartagena	507.60	1,053.67	59.86	Steel	Purse seiner

* These vessels also target medium pelagics and demersals
** There are two vessels registered under the same name. The authors do not know if this is the same vessel.
Source: Instituto Nacional de Pesca, personal communications, April 16, 1997.

Appendix A6d.--Colombia. Licensed tuna vessels, by company 1996

Company/ vessel	Fisheries	Country	Port	Size		Length	Hull Material	Vessel Type
				NRT	GRT			
				Tons		Meters		
Aragón, Adolfo								
Isabela	Tuna	Colombia	Buenaventura	41.00	118.89	21.96	Steel	Purse seiner
Aragón, Jorge								
Copespa IV	Tuna/finfish*	Colombia	Buenaventura	39.90	92.98	21.96	Iron	Combination vessel
Arpecol								
Don Celso	Tuna	Ecuador	Buenaventura	208.78	695.80	47.90	Steel	
Atunec S.A.								
Caroni	Tuna	Venezuela	Cartagena	313.80	916.40	65.30	Steel	Purse seiner
Atunes de Colombia (ATUNCOL)								
Amanda	Tuna	Vanuatu	Cartagena	460.00	1,535.00	66.20	Steel	Purse seiner
American Eagle	Tuna	Colombia	Cartagena	469.00	990.00	59.87	Steel	Purse seiner
Cabo de Hornos	Tuna	Vanuatu	Cartagena	257.20	850.00	55.60	Steel	Purse seiner
Dominador	Tuna	Ecuador	Cartagena	57.17	175.00	25.78	Steel	Purse seiner
Enterprise	Tuna	Colombia	Cartagena	594.00	1,159.92	61.21	Steel	Purse seiner
Gold Coast	Tuna	Vanuatu	Cartagena	504.17	1,428.24	69.89	Steel	Purse seiner
Grenadier	Tuna	Colombia	Cartagena	412.92	1,183.94	59.86	Steel	Purse seiner
Lucy	Tuna	Ecuador	Cartagena	80.12	355.12	31.80	Steel	Purse seiner
Montecristi	Tuna	Ecuador	Cartagena	311.30	601.20	39.94	Steel	Purse seiner
Sea Gem	Tuna	Vanuatu	Cartagena	489.00	1,078.00	223.50	Steel	
Sea Royal	Tuna	Vanuatu	Cartagena	881.72	1,820.50	230.63	Steel	Purse seiner
Tarqui	Tuna	Ecuador	Cartagena	80.12	355.12	31.80	Steel	Purse seiner
Tiuna	Tuna	Vanuatu	Cartagena	598.18	1,329.18	221.42	Steel	Purse seiner
Bahia Cupica								
Chidori Maru 21	Tuna	Japan	Buenaventura	241.00	379.00	49.39	Steel	Longliner
Chiyoda Maru 11	Tuna	Japan	Buenaventura	113.58	252.95	40.59	Steel	Longliner
Cocoliso	Tuna/finfish*	Colombia	Buenaventura	22.10	55.80	19.50	Steel	Combination vessel
Patricia Lynn	Tuna	Panama	Buenaventura	188.00	277.00	32.95	Steel	Purse seiner
Shoei Maru 28	Tuna	Japan	Buenaventura	205.60	379.00	48.03	Steel	Longliner
Buitrago, Alvaro								
Sea Rover	Tuna	Colombia	Tumaco	51.00	159.60	81.80	Steel	Purse seiner
Castillo, Otoniel								
OFI	Tuna	Colombia	Buenaventura	19.79	64.55	20.73	Wood	
Castrillón, Carlos								
Pilgrim	Tuna/finfish*	Belize	Tumaco	132.00	194.00	42.07	Iron	Combination vessel
C.I. Cimar S.A.								
Adriana	Tuna	Ecuador	Buenaventura	57.26	135.83	25.07	Steel	Purse seiner
Balbina	Tuna	Ecuador	Buenaventura	76.70	145.20	30.17	Steel	Purse seiner

Ciudad de Manta	Tuna	Ecuador	Buenaventura	74.24	210.45	30.90	Steel	Purse seiner
María	Tuna	Ecuador	Buenaventura	62.52	264.83	31.75	Steel	Purse seiner
María Fátima	Tuna	Ecuador	Buenaventura	119.45	398.18	32.40	Steel	Purse seiner
Ramoncho	Tuna	Ecuador	Buenaventura	43.22	159.39	27.35	Steel	Purse seiner
Romeo	Tuna	Ecuador	Buenaventura	44.16	132.00	24.08	Steel	Purse seiner
San Antonio V	Tuna	Ecuador	Buenaventura	78.25	395.19	31.55	Steel	Purse seiner
Saturno	Tuna	Ecuador	Buenaventura	34.35	163.89	26.46	Wood	
Southern Explorer	Tuna	Ecuador	Buenaventura	86.39	188.95	29.80	Wood	Purse seiner
Southern Queen	Tuna	Ecuador	Buenaventura	103.00	199.00	30.60	Steel	Purse seiner
Comercial Delfin Blanco								
Eileen Marie	Tuna	Colombia	Tumaco	133.00	485.00	34.87	Steel	Purse seiner
Rocio del Pilar	Tuna	Colombia	Buenaventura	125.02	224.60	29.02	Steel	Purse seiner
Copesnar								
Hua Yuan Yu 9	Tuna	China	Tumaco	69.00	198.00	31.30	Steel	Longliner?
Hua Yuan Yu 10	Tuna	China	Tumaco	69.00	198.00	31.30	Steel	Longliner?
Dispa Ltda.								
Huayaipe	Tuna/finfish*	Ecuador	Buenaventura	56.10	116.70	22.63	Steel	Combination vessel
Frigogan								
Atlantis	Tuna	U.S.A.	Cartagena	585.00	1,167.00	61.16	Steel	Purse seiner
Betty C	Tuna	Belize	Cartagena	396.00	758.64	55.17	Steel	Purse seiner
Bold Adventures	Tuna	U.S.A.	Cartagena	579.00	1,930.00	68.97	Steel	Purse seiner
Capitan Vincent Gann	Tuna	U.S.A.	Cartagena	689.00	1,387.00	68.97	Steel	Purse seiner
Don Bartolo	Tuna	Belize	Cartagena	242.00	606.00	50.29	Steel	Purse seiner
(La) Foca	Tuna	Venezuela	Cartagena	392.50	1,091.00	68.29	Steel	Purse seiner
Jane	Tuna	Venezuela	Cartagena	392.56	1,091.28	68.29	Steel	Purse seiner
Julie L	Tuna	Panama	Cartagena	596.00	1,516.20	67.52	Steel	Purse seiner
Miry Ann D	Tuna	Ecuador	Cartagena	175.55	585.17	50.04	Steel	Purse seiner
Pamela Ann	Tuna	Vanuatu	Cartagena	420.00	914.71	56.91	Steel	Purse seiner
South Seas	Tuna	U.S.A.	Cartagena	60.00	89.00	23.30	Steel	Purse seiner
Taurus I	Tuna	Venezuela	Cartagena	507.60	1,053.67	59.86	Steel	Purse seiner
Yelisava**	Tuna	Vanuatu	Cartagena	NA	606.00	50.38	Steel	Purse seiner
Yelisava**	Tuna	Vanuatu	Cartagena	302.00	606.00	50.09	Steel	
Frigopesca								
Betty Elizabeth	Tuna	Ecuador	Cartagena	90.60	403.98	34.00	Steel	Purse seiner
Don Abel	Tuna	Venezuela	Cartagena	391.92	1,027.88	62.75	Steel	Purse seiner
Fiorella	Tuna	Ecuador	Cartagena	205.58	612.41	39.46	Steel	Purse seiner
Génesis	Tuna	Venezuela	Cartagena	260.00	771.82	17.85	Steel	Purse seiner
Génesis	Tuna	Venezuela	Cartagena	260.00	673.77	47.85	Steel	Purse seiner
Jenny Margoth II	Tuna	Venezuela	Cartagena	544.00	1,815.26	69.02	Steel	Purse seiner
Ugavi	Tuna	Colombia	Cartagena	281.00	1,509.00	69.00	Steel	Purse seiner
Yushu Maru 51	Tuna	Japan	Cartagena	250.00	349.00	44.13	Steel	Longliner
Frigomarina Ltda.								
Géminis	Tuna	Panama	Buenaventura	82.00	244.00	32.01	Steel	Purse seiner
Tauro	Tuna	Panama	Buenaventura	62.00	246.00	32.01	Steel	Purse seiner

Guzmán, Jorge E.								
Antioqueño	Tuna/finfish*	Colombia	Buenaventura	30.62	45.03	14.81	Iron	Combination vessel
Hernández Castro, Iván								
Juliana	Tuna	Belize	Buenaventura	74.16	180.00	24.39	Steel	
Inversiones Echeverry								
Dario Andrés	Tuna/Demersals	Colombia	Tumaco	133.00	446.00	39.52	Steel	Combination vessel
Inversiones Micolta H.								
Montecarlo	Tuna/finfish*	Colombia	Buenaventura	56.11	107.69	21.85	Steel	Combination vessel
Martan, Oscar T.								
Marisela	Tuna/Demersals	Panama	Buenaventura	73.08	107.00	19.81	Steel	Combination vessel
Pesqueria Asturiana								
Victoria 8	Tuna	Panama	Cartagena	151.78	299.54	43.63	Steel	Longliner
Propescol								
Don Antonio	Tuna	Colombia	Buenaventura	472.00	876.00	55.25	Steel	Purse seiner
Don Fausto	Tuna	Colombia	Buenaventura	472.00	876.50	55.24	Steel	Purse seiner
Reina, Nelson A.								
Kathiuska Kellu	Tuna/Finish*	Panama	Buenaventura	47.00	158.00	27.43	Steel	Combination vessel
S.C.A. Coltuna Ltda.								
Ingalápagos	Tuna	Ecuador	Buenaventura	141.69	341.89	33.87	Steel	Purse seiner
Supertuna								
Amazonas	Tuna	Venezuela	Cartagena	461.00	916.20	65.30	Steel	Purse seiner
Canaima	Tuna	Venezuela	Cartagena	340.34	913.00	34.19	Steel	Purse seiner
Orinoco II	Tuna	Venezuela	Cartagena	591.00	1,314.00	58.86	Steel	Purse seiner
Western Pacific	Tuna	Ecuador	Barranquilla	98.76	322.54	36.93	Steel	Purse seiner
Vikingos								
Calypso	Tuna	Venezuela	Cartagena	387.15	990.25	65.85	Steel	Purse seiner
Carirubana	Tuna	Venezuela	Cartagena	386.12	973.30	65.85	Steel	Purse seiner
Cayude	Tuna	Venezuela	Cartagena	393.27	958.28	62.70	Steel	Purse seiner
Falcón	Tuna	Venezuela	Cartagena	382.12	973.30	65.85	Steel	Purse seiner
Mariano Otero	Tuna	Mexico	Cartagena	398.40	1,056.30	70.00	Steel	Purse seiner
San Lorenzo	Tuna	Ecuador	Cartagena	76.74	246.25	36.87	Steel	
Unaffiliated								
Ann Mary	Tuna	Venezuela	Cartagena	87.96	198.95	32.64	Steel	
Napoleón	Tuna	Venezuela	Cartagena	382.55	1,215.17	62.95	Steel	Purse seiner

* These vessels also target medium pelagics and demersals
** There are two vessels registered under the same name. The authors do not know if this is the same vessel.
Source: Instituto Nacional de Pesca, personal communications, April 16, 1997.

Appendix A7.--Colombia. Longliners operating from Colombian ports, 1997

Vessel	Nationality	Length	Port	Colombian partner
		Meters		
Chidori Maru 21	Japan	41	Buenaventura	Bahia Cupica
Chiyoda Maru 11	Japan	49	Buenaventura	Bahia Cupica
Hua Yuan Yu 9#	Taiwan	31	Tumaco	COPESNAR
Hua Yuan Yu 10#	Taiwan	31	Tumaco	COPESNAR
Lorimar##	Colombia	22	Cartagena	Océanos
Shoei Maru 28	Japan	48	Buenaventura	Bahia Cupica
Victoria 8	Panama*	44	Cartagena	Pescaderia Asturiana
Yushu Maru 51	Japan	44	Cartagena	Frigopesca**/Pescaderia Asturiana

Note: This list may not be all inclusive as it is possible that other companies may also be working with longliners that the authors have not identified. Other companies reportedly working with foreign longliners or previosly involved include:

COAPESCA: One unconfirmed report indicated that COAPESCA was working with foreign longliners in 1995, but a COAPESCA representative indicates that this report was eronious.

INPESCA: INPA reports that INPESCA was also working with foreign longliners in 1995 (appendix A5c). INPESCA officials, however, inform the authors that this is an error. The only longliners with which the company works are small, artisanal longliners. Boris Bentancourt, Executive Director, Asociación de Exportadores de Pescado Blanco (Ecuador), personal communications, May 15, 1996, and February and March 21, 1997.

Océanos: Company representatives report that for 4 years during the late 1980s they worked with Japanese longliners the *Yushu Maru 51*, and the *Victoria 1*.

* This is a flag-of-convenience registration. The Colombian association partner reports that the owner is Japanese. The authors note that other tuna vessels with a similar name are Korean (appendix A5a).

** Frigopesca is now part of Vikingos.

The authors believe that these vessels are longliners, but have been unable to contact the company to confirm it.

Shrimp trawler being converted for longlining.

Sources: Marta Lucia De la Pava, Manager, Bahia Cupica, personal communications, February 26, 1997; Roberto Osbina, Owner, Pescaderia Asturiana, personal communications, March 24, 1997; Bernardo Erazo, Production Manager, C.I. Océanos, personal communications, April 21, 1997; and Antonio Chalela Martínez, Manager, COAPESCA, personal communications, February 27, 1997.

Appendix A8a.--Colombia. Large* fishing vessels registered, 1993

Country** Vessel name	Class	Size	Built	Vessel type***
		GRT	Year	
Germany (GDR)				
ARC Malpelo		780	1981	566
Mexico				
Don Antonio	Atun VI	1,178	1991	516
Don Fausto		1,178	1989	510
United States				
Top Wave		971	1973	510

* 500 GRT or larger

** ONI vessel types

510 - Trawler

516 - Tuna seiner

566 - Fisheries research vessel

*** Country constructed

Source: U.S. Office of Naval Intelligence (ONI)

Appendix A8b.--Colombia. Large* fishing vessels registered, 1996

Country** Vessel name	Class	Size	Built	Vessel type***	Registration changes	
					Country	Date
		GRT	Year			
Germany (GDR)						
ARC Malpelo		780	1981	566		
Mexico						
Don Antonio	Atun VI	1,178	1991	516	Mexico	May 1993
Don Fausto		1,178	1989	510#	Mexico	May 1993
United States						
American Eagle		985	1975	516	Vanuatu	October 1995
Enterprise		1,159	1977	516	United States	June 1992###
Grenadier		985	1975	516	Vanuatu	November 1995
(El) Rey		971	1973	510	Vanuatu	December 1993##
Sandra C		990	1973	510	Vanuatu	May 1995

* 500 GRT or larger. Three other smaller tuna seiners (*El Dorado*, *Sea Rover*, and *Rocio*) are also active.
** ONI vessel types
510 - Trawler
516 - Tuna seiner
566 - Fisheries research vessel
*** Country constructed
# Although ONI reports these vessels to be be trawlers (code 510), the authors believe them to be tuna purse seiners (code 516).
Reflagged back to the United States in 1995. This vessel was probably the former *Top Wave* mentined in appendix A6a.
Later transferred to Vanuatu and then back to Colombia in 1995.
Source: U.S. Office of Naval Intelligence (ONI)

Appendix A9.--Colombia. Artisanal fishing fleet, Caribbean coast, 1997

Type	Boats
	Number
Chalupa*	180
Cayuco/Bote++	1,460
Bongo+++	8
Lancha+	739
Parguera++	12
Total	2,399

* Small duogout canoe (small cayuco)
** Dugout canoe
*** Dugout canoe to which plywoods have been added to increase the craft's width and height.
+ Small vessels constructed of various materials (wood, aluminum, fiberglass, or fiberglass-reinforced wood) which are made from different parts and components.
++ The larger size of the vessels allows them to remain offshore for up to 10 days. These are the largest of the Colombian artisanal vessels.
Source: Luis Manjarres Martínez, INPA/VECEP, personal communications, Arpril 17, 1997.

Appendix B1a.--Colombia. Fisheries catch, 1985-94

Year	Grounds			Total
	Caribbean	Pacific	Inland	
	1,000 Metric tons			
1980	5.1	24.1	46.9	76.2
1981	9.4	37.6	47.7	94.7
1982	6.4	16.0	49.0	71.4
1983	3.1	9.1	45.3	57.5
1984	7.5	17.7	59.4	78.5
1985	10.6	12.4	48.5	71.5
1986	10.4	17.0	56.0	83.4
1987	9.7	13.6	62.1*	85.5
1988	11.6	26.8	50.7	89.1
1989	10.4	49.1	38.8	98.3
1990	12.7	76.8	38.8	128.0
1991	10.7	73.5	25.0	109.2
1992	30.8*	79.4	48.3	158.5
1993	15.8	83.4	47.2	146.4
1994	17.6	53.5	51.7	122.7
1995	NA	91.1*	NA	167.1*

* Record
Source: FAO. *Yearbook of Fishery Statistics*, various years.

Appendix B1b.--Colombia. Pacific commercial reduction catch*, by port 1993-95

Year	Tumaco		Other ports		All Pacific ports		
	Anchovy*	Other***	Anchovy**	Other***	Anchovy**	Other***	Total
	Metric tons						
1993	-	106	24,240	1,870	24,240	1,976	26,216
1994	4,692	2,570	14,761	891	19,453	3,461	22,914
1995	15,312	352	15,550	521	30,862	873	31,735

* Excludes the tuna purse seine fishery.
** Carduma (*Cetengraulis mysticetus*)
*** All other finfish, excepted tuna taken by purseseiners
Source: INPA, *Boletín Estadistico Pesquero*, various years.

Appendix B2a.--Colombia. Swordfish catch, 1980-95

Year	Billfish catch	
	Swordfish	Other
	Metric tons	
1980	-	-
1981	-	-
1982	-	-
1983	-	-
1984	-	-
1985	-	-
1986	-	-
1987	-	-
1988	-	-
1989	-	-
1990	-	-
1991	29	-
1992	-	-
1993	-	-
1994	-	-
1995	-	-

Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix B2b.--Eastern Tropical Pacific. Swordfish seasonaity in coastal waters, 1952-85

Month	Area*									
	Ecu/No. Peru	Colombia Coast	Colombia Offshore	Panama	C. Rica	Nic./ El Sal	Guate/ So. Mex	Mexico*** South	Mexico*** Central	Mexico*** North
	Yields**									
January	3	2	3	-	2	2	3	2	2	4
February	4	3	3	1	2	2	3	2	2	4
March	3	4	3	1	2	3	3	2	2	4
April	4	3	3	1	2	4	4	3	2	4
May	4	2	3	1	2	4	3	2	2	4#
June	3	2	3	1	2	3	2	2	2	4
July	3	2	2	1	2	2	3	2	2	4
August	4	2	2	1	2	2	3	2	2	3
September	4	2	2	1	1	1	3	2	2	4
October	4	2	3	1	2	2	2	2	2	4#
November	4	2	2	1	1	2	2	2	2	4
December	4	2	3	1	3	2	2	2	2	4

Note: The seasonality described above appears to differ with the 1991 catch data reported in Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.
* Rough country orientation of data in source. Except as noted otherwise, the area indicated is the 5° square immediately along the coast.
** Yields (fish per 1,000 hooks):
1 - 0
2 - <0.05
3 - 0.051-0.16
4 - 0.16 >
*** The Mexican results cover several 5° squares and have been summarized into these three regions,
# The lowest yields are reported from May through October.
Source: Oscar Sosa-Nishizaki and Makato Shimizu, "Spatial and temporal CPUE trends and stock unit inferred from them for the Pacific swordfish caught by the Japanese tuna longline fishery," *Bul. Nat. Res. Far Seas Fish.*, Nº28, March 1991, pp. 80-85.

Appendix B3a1.--Colombia. Billfish catch, 1992-95

Year	Catch	
	Billfish*	Swordfish
	Metric tons	
1992	190	Negl
1993	150	29
1994	59	Negl
1995	55	Negl
1996	197	Negl

NA - Not available
* Sailfish and marlin
Source: INPA as cited in U.S. Embassy, message number 8912, June 29, 1995 (1992-94 data); INPA, *Boletín Estadistico Pesquero*, 1995 (1995 data); and Fernando Reyes Navarro, Subdirector de Ordenamiento y Desarrollo Pesquero, Instituto Nacional de Pesca y Acuicultura, personal communications, April 8, 1997 (1996 data).

Appendix B3a2.--Colombia. Billfish catch, 1992-95

Species/ fishery	Year											
	1992			1993			1994			1995		
	Car	Pac	Total	Car	Pac	Total	Car	Pac	Total	Car	Pac	Total
	Metric tons											
Sailfish												
Artisanal	22.3#	-*	22.3*	-	15.1	15.1	0.1	15.2	15.3	Negl	37.3	37.3
Commercial	-	109.7*	109.7*	62.3	18.2	80.5	-	-	-	-	-	-
Total	22.3#	115.6	137.9	62.3	33.3	95.1	0.1	15.2	15.3	Negl	37.3	37.3
Marlin												
Artisanal	2.8	0.6*	3.4*	0.9	0.6	1.5	0.1	15.3	15.4	0.1	6.4	6.5
Commercial	2.1	38.4*	40.5*	9.1	49.5	58.6	-	38.5	38.5	-	11.7	11.7
Total	4.9	41.2	46.1	10.0	50.1	60.1	0.1	53.8	53.9	0.1	18.1	18.2
Total billfish												
Artisanal	25.1#	0.6*	25.7*	0.9	15.7	16.6	0.2	30.5	30.7	0.1	43.7	43.8
Commercial	2.1	148.1*	150.2*	71.4	67.7	139.1	-	38.5	38.5	-	11.7	11.7
Total	27.2#	156.8	175.9	72.3	83.4	155.7	0.2	69.0	69.2	0.1	55.4	55.5

Note: Discrepancy with appendix B3a1 is unexplained.
Car - Caribbean
Pac - Pacific
* Not including Tumaco. The country-wide totals do include Tumaco.
# One INPA offical working with Caribbean artisanal fishermen reports that the 22.3 t of sailfish was actually taken in the Pacific. Luis Manjarres, INPA/VECEP, personal communications, April 17, 1997.
Source: INPA, *Boletín Estadistico Pesquero*, various years.

Appendix B3a3.--Colombia. Billfish catch, 1996.

Species/ Coast	Fishery		Total
	Artisanal	Commercial	
	Metric tons		
Black Marlin			
Caribbean	-	-	-
Pacific	-	137.3	137.3
Subtotal	-	137.3	137.3
Blue Marlin			
Caribbean	-	-	-
Pacific	2.8	13.1	15.9
Subtotal	2.8	13.1	15.9
White Marlin			
Caribbean	-	-	-
Pacific	-	37.2	37.2
Subtotal	-	37.2	37.2
Sailfish			
Caribbean	1.5	-	1.5
Pacific	Negl	Negl	Negl
Subtotal	1.5	Negl	1.5
Spearfish			
Caribbean	-	-	-
Pacific	2.3	2.7	5.0
Subtotal	2.3	2.7	5.0
Swordfish			
Caribbean	-	-	-
Pacific	Negl	Negl	Negl
Subtotal	Negl	Negl	Negl
Total	6.6	190.3	196.9

Source: Fernando Reyes Navarro, Subdirector de Ordenamiento y Desarrollo Pesquero, Instituto Nacional de Pesca y Acuicultura, personal communications, April 8, 1997.

Appendix B3b1.--Colombia. Shark catch, 1985-95

Year	Coast		Total	Proportion Pacific
	Caribbean	Pacific		
	Metric tons			Percent
1985	55.0	419.0	474.0	88
1986	51.0	904.0	955.0	95
1987	83.0	838.0	921.0	91
1988	150.0	463.0	613.0	76
1989	143.0	789.0	932.0	85
1990	36.0	582.0	618.0	94
1991	23.0	327.0	350.0	93
1992	286.4	459.0	745.4	62
1993	307.2	316.0	623.2	51
1994	102.0	365.1	467.1	78
1995	45.9	161.6	207.5	78

Source: INPA, *Boletín Estadistico Pesquero*, various years.

Appendix B3b2.--Colombia. Pacific catch of shark and related species, by port 1992-95

Year/ species	Artisanal		Commercial		Total	
	Tumaco	Other	Tumaco	Other	Tumaco	Other
	Metric tons					
1993						
Dorado	119.3	170.0	3.0	57.8	122.3	227.8
Shark	123.3	58.9	14.5	119.3	137.8	178.2
Tuna*						
Albacore	8.9	3.9	-	-	8.9	3.9
Bigeye	-	-	-	-	-	-
Skipjack	-	-	-	-	-	-
Yellowfin	-	-	-	-	-	-
Other**	10.1	101.6	-	-	-	-
Billfish						
Marlin	5.4	0.6	32.5	17.0	37.9	17.6
Sailfish	-	15.1	-	18.2	-	33.3
1994						
Dorado	420.7	8.2	-	57.3	420.7	65.5
Shark	120.3	50.2	2.6	192.1	122.9	242.3
Tuna*						
Albacore	1.8	15.9	1.2	0.2	3.0	16.1
Bigeye	-	-	-	-	-	-
Skipjack	8.9	1.2	-	-	-	-
Yellowfin	6.5	-	0.2	-	6.7	-
Other**	6.4	29.8	-	9.8	6.4	39.6
Billfish						
Marlin	14.0	1.3	-	38.5	14.0	39.8
Sailfish	Negl	15.1	-	-	Negl	15.1
1995						
Dorado	36.4	15.4	3.8	233.7	40.2	249.1
Shark	55.1	54.4	15.7	75.0	70.8	129.4
Tuna*						
Albacore	10.2	33.8	-	-	10.2	33.8
Bigeye	-	-	-	-	-	-
Skipjack	3.1	5.2	-	-	3.1	5.2
Yellowfin***	5.5	-	-	-	5.5	-
Other**	36.5	83.9	37.7	0.1	74.2	84.0
Billfish						
Marlin	1.9	4.5	-	11.7	1.9	16.2
Sailfish	-	37.3	-	-	-	37.3

Note: The great bulk of the commercial catch (over 95 percent) in both Tumaco and other Pacific ports during 1995 was small pelagics for reduction to fishmeal (appendix B1b).
* Albacore, skipjack, bigeye, and yellowfin, not including commercial tuna purse seine fishery.
** Other or unidentified
*** Much of the tuna in other is probably yellowfin.
Source: INPA, *Boletín Estadistico Pesquero*, various years.

Appendix B3c1.--Colombia. Artisanal catch, by month, 1994

Coast/month species	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Metric tons												
Caribbean#													
Billfish													
Marlin	-	-	-	0.1	-	-	-	-	-	-	-	-	0.1
Sailfish	-	-	-	-	0.1	-	-	-	-	-	-	-	0.1
Dorado	-	-	Negl	3.8	Negl	Negl	-	Negl	-	-	-	-	3.8
Shark													
Toyo	0.8	0.7	0.8	0.6	0.6	0.6	1.1	2.3	1.0	0.7	2.1	3.0	14.4
Other	10.6	1.2	34.5	Negl	10.0	Negl	0.5	0.2	-	-	-	-	57.0
Sierra	1.8	1.6	1.7	1.3	2.6	3.8	1.6	0.7	3.0	3.4	2.1	3.2	26.8
Tunas													
Bluefin***	34.6	-	-	-	10.5	-	-	-	-	-	-	-	45.1
Pacific##													
Billfish													
Marlin	0.1	-	0.1	0.2	0.1	0.6	-	-	-	Negl	Negl	0.2	1.3
Sailfish	0.2	-	0.4	0.7	10.3	3.2	Negl	Negl	-	0.1	0.1	0.1	15.1
Dorado	0.8	Negl	0.5	0.9	0.9	1.5	-	0.1	-	0.1	0.6	2.7	8.2
Sharks*	5.7	4.8	7.5	6.4	11.7	4.3	0.1	1.4	2.0	1.6	0.4	3.4	50.2
Sierra	39.9	16.8	22.0	8.0	10.5	24.0	4.1	1.9	14.5	2.0	16.2	0.6	160.5
Tunas**													
Albacore	0.5	0.1	3.4	5.8	0.5	3.1	1.2	-	-	0.2	0.1	1.2	15.9
Blackfin	0.1	Negl	Negl	Negl	0.1	4.3	Negl	-	-	0.2	Negl	Negl	4.8
Bluefin**	0.8	-	2.8	3.8	5.2	8.9	3.8	0.5	0.2	3.9	Negl	Negl	29.8
Skipjack	0.2	0.2	0.2	0.1	0.4	Negl	-	-	-	0.1	Negl	Negl	1.2

Does not include the catch off the Caribbean islands of San Andres and Santa Marta. The San Andres catch is very small, but bigeye tuna, sierra, and shark are landed in Santa Marta. The bigeye catch of 198 t is particularly notable.
Except Tumaco
* Toyo
** May be yellowfin
Source: INPA, *Boletín Estadistico Pesquero*, 1994.

Appendix B3c2.--Colombia. Commercial catch, by month, 1994

Coast/month species	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Metric tons												
Caribbean#													
Tuna***	-	-	-	-	-	-	-	-	-	-	-	-	-
Dorado	-	-	Negl	-	Negl	Negl	Negl	-	Negl	Negl	Negl	-	0.1
Sierra	0.1	-	-	-	-	-	Negl	Negl	Negl	0.1	-	-	0.1
Shark**	1.6	0.8	1.1	0.6	0.9	0.4	0.6	0.3	0.4	0.5	0.1	0.2	7.5
Pacific*													
Billfish													
Marlin	2.4	11.2	2.2	2.0	4.7	2.7	0.7	2.9	3.4	0.3	2.2	4.0	38.5
Dorado	10.6	24.3	8.3	0.9	0.1	0.1	0.2	0.3	1.0	8.3	1.4	1.8	57.3
Shark**	4.8	29.8	24.5	53.6	16.0	23.0	7.3	11.2	6.7	0.4	8.6	6.2	192.1
Sierra	1.7	1.1	Negl	0.6	Negl	1.0	Negl	0.2	0.6	0.8	-	-	6.2
Tuna***													
Albacore	-	Negl	-	0.2	-	Negl	-	-	-	-	-	-	0.2
Blackfin	Negl	-	-	-	-	-	-	-	-	-	-	-	Negl
Bluefin****	-	-	-	-	9.8	-	-	-	-	-	-	-	9.8

Except San Andres
* Except Tumaco
** Toyo
*** Does not include the landings of the country's large domestic and foreign purseseine fleet. See appendix B3d for overall tuna landings.
**** Probably yellowfin
Source: INPA, *Boletín Estadistico Pesquero*, 1994.

Appendix B3c3.--Colombia. Artisanal and commercial billfish catch, 1992-95

Coast/year/month species	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Metric tons												
Artisanal Fishery													
Caribbean#													
Marlin													
1993	-	-	-	-	Negl	0.2	0.6	0.1	-	-	Negl	-	0.9
1994	-	-	-	0.1	-	-	-	-	-	-	-	-	0.1
1995	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1
Sailfish													
1993	-	-	-	-	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	0.1	-	-	-	-	-	-	-	0.1
1995	-	-	-	-	-	-	-	-	-	-	Negl	-	Negl
Pacific##													
Marlin													
1993	0.2	0.1	0.1	-	0.1	-	-	0.1	0.1	-	-	-	0.6
1994	0.1	-	0.1	0.2	0.1	0.6	-	-	-	Negl	Negl	0.2	1.3
1995	0.3	0.3	1.6	0.2	0.1	1.1	0.2	0.3	Negl	0.2	0.1	0.3	4.5
Sailfish													
1993	-	-	0.1	5.0	6.1	2.8	-	-	-	0.3	0.3	0.5	15.1
1994	0.2	-	0.4	0.7	10.3	3.2	Negl	Negl	-	0.1	0.1	0.1	15.1
1995	0.1	0.3	4.6	3.2	25.5	1.7	0.5	0.4	0.2	0.2	0.3	0.2	37.3
Commercial fishery													
Caribbean#													
Marlin													
1993	-	0.1	0.1	0.5	Negl	-	2.0	-	-	-	1.1	-	3.7
1994	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	-	-	-	-	-	-	-	-	-	-	-	-	-
Sailfish													
1993	-	-	-	Negl	Negl	-	62.3	-	-	-	-	-	62.3
1994	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific##													
Marlin													
1993	0.9	-	1.4	1.3	-	-	4.0	1.3	1.5	3.1	0.4	3.3	17.0
1994	2.4	11.2	2.2	2.0	4.7	2.7	0.7	2.9	3.4	0.3	2.2	4.0	38.5
1995	2.9	3.4	1.9	0.4	2.7	-	-	-	0.4	-	-	-	11.7
Sailfish													
1993	18.2	-	-	-	-	-	-	-	-	-	-	-	18.2
1994	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	-	-	-	-	-	-	-	-	-	-	-	-	-

Does not include the catch off the Caribbean islands of San Andres and Santa Marta. The San Andres catch is very small, but bigeye tuna, sierra, and shark are landed in Santa Marta. The bigeye catch of 198 t is particularly notable.
Except Tumaco
Source: INPA, *Boletín Estadistico Pesquero*, various years.

Appendix B3d.--Colombia. Tuna catch, 1980-95

Year	Tuna catch	
	Yellowfin	Skipjack
	Metric tons	
1986	NA	-
1987	NA	-
1988	16,814	-
1989	28,920	-
1990	31,798	2
1991	30,246	1,653
1992	37,889	5,182
1993	35,589	12,635
1994	18,890	3,807
1995	34,771	7,391

NA - Not available
Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix B4.--Colombia. Species composition of retained longline catch

Sector/ company	Vessels*		Grounds	Catch							
	Nationality	Number		Tuna	Shark	Marlin	Sailfish	Swordfish+Sierra	Dorado		Other
		Number		Percent							
1980s											
Commercial											
Océanos	Japanese	2	Pacific/Car-Atl#	80	15	NA	NA	Negl	Negl	Negl	NA
1997											
Commercial											
Bahia Cupica♦♦	Japanese	1	Pacific#	85⁂	12	Negl	Negl	-⁂⁂	Negl	Negl	3
P. Asturiana♦♦♦	Panamanian**	1	Caribbean/Atlantic#	85	10♦	2	1	-⁂⁂	1	Negl	1
Frigopesca•/											
P. Asturiana♦♦	Japanese	3	Caribbean/Atlantic#	80***	16♦	2	2	Negl	NA	Negl	Negl
Artisanal••	Colombian	22###	Pacific coastal	NA•••	NA	NA	NA	Negl	NA	NA	NA##

Note: INPA reports that INPESCA was also working with foreign longliners (appendix A5c). INPESCA officials, however, inform the authors that this is an error. The only longliners with which the company works are small, artisanal longliners. Javier Bentancourt, Manager, INPESCA, personal communications, February 20, 1997. This list may not be all-inclusive as it is possible that other companies may also be working with longliners.
Within and beyond the Colombian EEZ. Fishing operations in the Atlantic extend to the Mid-Atlantic Ridge (40°-50°W).
Including sierra and bravo (English name unknown)
Most of the vessels are based in Buenaventura (22), but a few (2) are based at Tumaco.
* Individual vessels by company are detailed in appendix A6d. The foreign-flag vessels work in association with the indicated Colombian company.
** This is a flag-of-convenience registration. The Colombian association partner reports that the owner is Japanese. The authors note that other tuna vessels with a similar name are Korean (appendix A5b).
*** Primarily yellowfin, bigeye, and albacore.
• Frigopesca is now part of Vikingos.
•• Semi-commercial fleet operated by individual vessel owners. Many work out of Buenaventura with INPESCA. A few are based in Tumaco. Some of these vessels also occasionally deploy driftnets.
••• Primarily skipjack and bigeye
⁂ Mostly yellowfin and small amounts of bigeye
⁂⁂ Occasional swordfish are taken, but the numbers are very limited
♦ Mostly blue and mako sharks.
♦♦ Rough multi-year average
♦♦♦ 1996 results
+ Despite the minimal swordfish landings reported by the associated Colombian companies, Japanese longline fishermen through 1993 were reporting activity for swordfish along Colombia's Caribbean coast. ICCAT, "1994 SWO background document: Figures," *ICCAT Collective Volume of Scientific Papers*, XLIV (3) (ICCAT: Madrid, Spain, 1995), p. 91.
Sources: Marta Lucia De la Pava, Manager, Bahia Cupica, personal communications, February 26, 1997; Roberto Osbina, Owner, Pescaderia Asturiana, personal communications, March 24 and April 10, 1997; Juan Valverde, INPA/VECEP, personal communications, February 24, 1997; and Benardo Erazo, Production Manager, C.I. Océanos, personal communications, April 21, 1997.

Appendix C1.--Colombia. Companies processing tuna, 1995

Company	Capacity		Production 1994
	Production	Storage	
	Tons/hour	Tons	Tons
ARPECOL	20*	1,500	8,600*
Atunec	100	3,000	NA
Atunes de Colombia	150	5,000	60,000
CIMAR	30	1,000	NA
Copescol	40	3,500	5,000
Frigogan	60	3,000	NA
Frigopesca	50	2,500	NA

Note: Reports from the individual companies provide somewhat different data on capacity and production. The ARPECOL appears erronious.
* ARPECOL reports that the above data is enrroneous. They did some tests on tuna in 1994, but production was only about 80 tons. They do hope, however, to increase tuna production. Jaime Bravo Lozano, Manager, Arpecol, personal communicatins, February 19, 1997.
Source: U.S. Embassy, Bogota, "World swordfish fisheries study: Colombian information," mesage number 8912, June 29, 1995 and INPA, Subgerencia de Operaciones, Division de Registro y Control, unpublished data, July 23, 1995.

Appendix C2.--Colombia. Tuna processing facilities by port, 1995

Coast/ port	Company
Caribbean	
	Baranquilla
		Atunec
		Frigogan
	Cartagena
		Atunes de Colombia
		FRIGOPESCA*
Paific	
	Buenaventura
		ARPECOL
		CIMAR
		COPESCOL
	Cali
		COPESCOL
		CIMAR
	Tumaco
		CIMAR

* Incorporated into Vikingos in 1996.
Source: INPA, Subgerencia de Operaciones, Division de Registro y Control, unpublished data, July 23, 1995.

Appendix D.--Colombia. Directory of agencies and companies involved with swordfish and related fisheries

Government Agencies

Instituto Nacional de Pesca y Acuicultura (INPA)
Diagonal 27 #1509, 3er Piso
Bogota
COLOMBIA
Tel: (57-1) 329-3866,320-3866, 340-2338
Fax: (57-1) 340-2338

Programa de Cooperación Técnica para la Pesca (VECEP)
Apartado Postal 970
Buenaventura
COLOMBIA
Telfax: (57-224) 18991/92

VECEP
Carrera 8 #26B-39
Apartado Aéreo 1690
Santa Marta
COLOMBIA
Tel: (57-54) 212-721
FAX: (57-54) 212-455

PRODECOSTA
AA 27770
Bogotá
COLOMBIA

Projecto de Pesca Artesanal Maritima
INPA/CIID/UNIMAGDALENA
Address unavailable

Proyecto CISP-CORPAMAG
Carrera 5N.22-25, Of. 421
Edificio Vives
Santa Marta
COLOMBIA
Tel:

Research Organizations

Instituto de Investigaciones Marinas y Costeras (INVEMAR)
Ministerio del Medio Ambiente
Apartado Aéreo 1016
Santa Marta
COLOMBIA
Tel: (57-54) 214-413, 214-775, 211-380
FAX: (57-54)-211-377
Internet: olbaena@santamarta.cetcol.net.co

Diego Muñoz/Monica Alfaro, Biólogos Marino
Apartado Aéreo 20441
El Laguito
Cartagena
COLOMBIA

Industry

Trade Association

Armadores Pesqueros Colombianos (ARPECOL)
Km. 4 El Pinal
Buenaventura
COLOMBIA
Tel: (57-224) 25-448
FAX: (57-224) 44-828

Camara de la Industria Pesquera
Carrera 13# 2645
Piso 6
Bogotá
Colombia
Tel: (57-1) 334-9620
Fax: (57-1) 281-3188, 341-9988

Companies

Atunes de Colombia/Seatech
Via a Mamonal, Km. 8
AA 8237
Cartagena
COLOMBIA
Tel: (57-5) 668-5723
FAX: (57-5) 668-5648

Atunes y Enlatados del Caribe (ATUNEC)
Zona Franca
AA 51498
Baranquilla
COLOMBIA
Tel: (57-5) 344-8462

Bahia Cupica
Avenida Simon Bolivar 2288, Km. 4
Buenaventura
COLOMBIA
Tel: (57-224) 18-443/444/445, 48-328/329/330
FAX: (57-224) 46-098

CIMAR
Km. 5 El Mangle No. 28-40
Buenaventura
COLOMBIA
Tel: (57-224) 483-32/33/34/35/36/37

(C.I.) COAPESCA S.A.
Apartado Aéreo 27
Cartagena
COLOMBIA
Tel: (57-5) 662-5154/5282/5410/5538/5666
Fax: (57-5) 662-6178

Compania Pesquera Colombiana (COPESCOL)
Closed in 1995

Corporación Pesquera de Nariño (COPESNAR)
Terminal Pesquero Isla el Morro
Apt. Postal 399
Tumaco-Nariño
COLOMBIA
Tel: (57-27) 272-977
FAX: (57-27) 272-385

Frigomarina
Tel: (57-224) 18577/78

Frigopesca
Tel: (57-5) 665-3793
Fax: (57-5) 668-5410

Frigorifico Ganadero (FRIGOGAN)
Calle 2ª, No. 38-121
AA 51911
Baranquilla
COLOMBIA
Tel: (57-5) 344-8495/8549
FAX: (57-5) 344-8993

Frigorífico y Pesca de Cartagena (FRIGOPESCA)
Via a Mamonal
AA 2012
Cartagena
COLOMBIA
Tel: (57-5) 672-147, 672-207
FAX: (57-5) 672-161

INDUPESCA
See Vikingos

INPESCA
Apartado Aéreo 656
Buenaventura
Colombia
Tel: (57-224) 27935
FAX: (57-224) 27937

(C.I.) Océanos
Apartado Postal 4264
Cartagena
Colombia
Tel: (57-5) 668-5188
FAX: (57-5) 668-5266

MARCOL
Apartado Aéreo 6578
Cali
Colombia
Telfax: (57-2) 660-1554

Pesqueria Asturiana
Barrio Prado
Calle 22 #3007
Cartagena
COLOMBIA
Tel: (57-5) 662-7008, 662-6953
FAX: (57-5) 662-5521

Sea Tech: See Atunes de Colombia

Sigma Consultores
Apartado Aereo 1578
Cali
COLOMBIA

UNIFEM
Apartado Aéreo 13458
Bogotá
Colombia

Vikingos de Colombia
Carretera Mamoná
Cartagena
COLOMBIA
Tel: (57-5) 668-5345 or 5211
FAX: (57-5) 668-5410 or 5028

Appendix E1.--Colombia. Fishery exports, 1991-94

Product	Year				
	1991	1992	1993	1994	1995
			US$ Million		
Fresh fish	1.4	1.0	1.2	1.6	
Frozen fish	49.0	45.9	32.3	29.1	
Frozen tuna***	-	-	-	2.3	
Fresh/frozen fillets	14.3	31.4	18.4	21.6	
Frozen shrimp	9.9	21.1	33.6	48.4	
Canned tuna	3.9	10.1	13.8	48.9	
Shark fins*	-	-	-	2.3	
Other products	12.6	11.5	10.5	14.4	
Total**	91.1	121.0	109.8	168.6	

* And other escualos
** Totals may not agree due to rounding
*** The small entries for tuna are unexplained, presumably the source is not including product taken by foreign-flag vessels.
Source: DIAN/ANDI in Armando Hernández R., "Dinamica del sector pesquero en los años 90," *ANDI*, March-April 1995, p. 75.

Appendix E2a.--Colombia. Swordfish exports by destination, 1991-95

Destination	Years						
	1990	1991	1992	1993	1994	1995	1996
				Metric tons			
United States	-	-	5	4	-	-	-
Japan*	2	2	2	8	1	2	
European Union	NA	-	-	-	-	-	
Others**	NA	NA	NA	NA	NA	NA	
Total	2	2	7	12	1	2	

\# Through November
* NMFS estimates that the swordfish portion of billfish shipments is about 5 percent. This may be a high estimate because sailfish appears to be taken in much larger quantities than swordfish.
** Swordfish shipments to other countries are believed to be non-existent or negligible.
Source: Various

Appendix E2b.--Colombia. Tuna* exports, 1991-94

Destination	Year			
	1991	1992	1993	1994
	Metric tons			
European Union	4,461.8	12,386.9	7,289.1	18,986.7
Japan	NA	NA	NA	NA
United States				
Continental	-	-	2,228.1	807.2
Puerto Rico	1,036.4	-	159.0	1,673.9

NA - Not available
* Both frozen loins and canned product
Source: U.S. Embassy, "World swordfish fisheries study: Colombian information," mesage number 8912, June 29, 1995

Appendix E3a.--United States. Swordfish imports from Colombia, 1975-94

Year	Commodity		Total
	Fresh	Frozen	
	Metric tons		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985	-	-	-
1986	-	-	-
1987	-	-	-
1988	-	-	-
1989	-	-	-
1990	-	-	-
1991	-	-	-
1992	5.3	-	5.3
1993	3.5	-	3.5
1994	-	-	-
1995	-	-	-
1996	-	-	-

Source: U.S. Bureau of the Census

Appendix E3b.--United States. Swordfish imports from Colombia, 1975-95

Year	Commodity		Total
	Fresh	Frozen	
	U.S.$1,000		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985	-	-	-
1986	-	-	-
1987	-	-	-
1988	-	-	-
1989	-	-	-
1990	-	-	-
1991	-	-	-
1992	9	-	9
1993	12	-	12
1994	-	-	-
1995	-	-	-
1996	-	-	-

Source: U.S. Bureau of the Census

Appendix E3c.--United States. Fishery imports from Colombia, 1991-96

Product form	Year						
	1990	1991	1992	1993	1994	1995	1996
				US$ 1,000			
Fresh							
Tuna#	13	5	23	-	-	-	-
Swordfish	-	-	9	12	-	-	-
Shark	-	3	4	11	-	-	-
Tilapia, fillets	-	-	372	680	445	1,948	1,276
Grouper	-	75	531	1,519	1,352	506	45
Snapper	-	46	9	-	11	1	-
Unspecifed##							
Marine fillets	291	650	540	344	165	1,014	332
Other	554	1,539	559	2,130	2,937	2,160	460
Frozen							
Tuna	1,281♦	2,959♦	-	-	5,393♦	15,445♦	6,107♦
Shrimp	31,199	36,627	24,582	25,500	29,301	24,842	26,453
Unspecified,							
Marine fillets	38	217	141	5	-	-	-
Blocks	-	242	-	-	-	-	-
Other	-	53	87	2	-	-	4,289
Canned							
Tuna	-	-	-	3,511	1,657	-	-
Shark fins*	20	-	-	123	243	367	374
Other products	6,853	12,359	11,235	4,927	3,411	4,851	439
Totals							
Shrimp	31,199	36,627	24,582	25,500	29,301	24,842	26,453
Tuna	1,293	2,964	23	3,511	7,050	15,445	679
Non-shrimp/tuna	7,756	15,184	13,487	9,753	8,564	10,847	12,643
Grand Total**	40,248	54,775	38,092	38,764	44,915	51,134	39,775

Yellowfin and/or albacore
Small quantities of various specified marine finfish species (mackerel and various groundfish) not included.
♦ All or mostly loins
* And other escualos
** Totals may not agree due to rounding
Source: U.S. Bureau of the Census

Appendix E3d.--United States. Fresh imports from Colombia, 1992-96

Year	Fishery		Total
	Freshwater	Marine	
	$1,000		
1992	1,108	1,708	2,816
1993	727	4,016	4,743
1994	445	4,465	4,910
1995	1,989	3,832	5,821
1996	1,331	782	2,113

Source: U.S. Bureau of the Census.

Appendix E3e.--United States. Fishery imports from Colombia, by product form, 1990-96

Product form	Year						
	1990	1991	1992	1993	1994	1995	1996
				US$ Million			
Live	-	-	Negl	-	-	-	Negl
Fresh	0.9	2.4	2.8	4.7	4.9	5.8	2.1
Frozen	37.0	49.4	32.8	29.0	37.1	43.8	36.8
Canned	Negl	-	Negl	3.5	1.7	3.0	-
Other	2.2	2.6	2.2	1.5	1.3	1.3	0.8
Total*	40.0	54.3	37.8	38.8	44.9	51.0	39.8

* Totals may not agree due to rounding.
Source: U.S. Bureau of the Census.

Appendix E3f.--United States. Tuna imports from Colombia, 1990-96

Product form/ species	Year						
	1990	1991	1992	1993	1994	1995	1996
				US$ 1,000			
Fresh							
Albacore	-	5	-	-	-	-	-
Yellowfin	13	-	-	-	-	-	-
Unspecified	-	-	23	-	-	-	-
Frozen							
Albacore	-	-	-	-	135	-	-
Skipjack	-	-	-	-	-	-	283
Yellowfin							
Eviserated	8	3	-	-	22	-	-
Whole	-	-	-	-	-	-	170
Unspecified							
Loins (>6.8 kg)	1,272	2,956	-	-	5,120	15,445	5,428
Loins (<6.8 kg)	-	-	-	-	117	-	-
Other	-	-	-	-	-	-	226
Canned							
Unspecified							
Not in oil	-	-	-	3,511	1,657	-	-
Total*	1,293	2,964	23	3,511	7,050	15,445	6,107

* Totals may not agree due to rounding.
Source: U.S. Bureau of the Census.

Appendix E3g.--United States. Tuna embargoes on Colombia

Type*	Date		Products covered
	Imposed	Rescinded	
Primary	4/27/92	NA	Purseseine caught yellowfin
Intermediate	1/31/92#	10/30/92##	All yellowfin
Primary	9/28/94		Purseseine caught yellowfin

ETP - Eastern Tropical Pacific
NA - Not available
YFT - Yellowfin tuna
* All of the embargoes on Colombia are imposed under the authority of the Marine Mammal Protection Act.
# A U.S. District Court order (Northern District of California) on January 10, 1992, significantly expanded the scope and coverage of the intermediate embargoes.
Intermediate embargo lifted on the basis of a new definition of intermediate nation in the International Dolphin Conservation Act signed October 26, 1992.
Source: NMFS, Southwest Regional Office.

Appendix E4a1.--Japan. Billfish imports from Colombia, 1986-94

Year	Quantity	
	Billfish	Swordfish
	Metric tons	
1986	77	4E
1987	89	4E
1988	31	2E
1989	24	1E
1990	36	2E
1991	36	2E
1992	41	2E
1993	156	8E
1994	22	1E
1995	35	2E
1996	55	3E

E - Estimated swordfish proportion of billfish imports (5 percent).
Source: Japan Tariff Association, *Japan Exports & Imports*, various years.

Appendix E4a2.--Japan. Billfish imports from Colombia, 1986-96

Year	Product form			Total*
	Fresh	Frozen		
		Fillets	Other	
		Metric tons		
1986	-	12**	65	77**
1987	-	16**	73	89**
1988	-	8**	23	31**
1989	-	9**	15	24**
1990	-	7**	29	36**
1991	-	11**	25	36**
1992	-	7**	34	41**
1993	-	27	129	156
1994	-	10	12	22
1995	-	14	22	35
1996	-	21	34	55

* Totals may not agree due to rounding.
** Until 1993 the fillets category included some tuna fillets.
Source: Japan Tariff Association, *Japan Exports & Imports*, various years.

Appendix F.--Colombia. Cost of INPA permits for businesses and vessels to fish for tuna and other species

Permit	Cost
	US$
Business permit	372.00
Additional vessel	124.00
Fishing permit	19.84 (per net ton)
Sport fishing license	14.88

Source: U.S. Embassy, "World swordfish fisheries study: Colombian information," mesage number 8912, June 29, 1995

Appendix G.--Colombia. Species glossary

Spanish	English	Scientific
Caribbean coast		
Atunes	Tunas	Thunnus sp.
Atún	Blackfin	T. atlanticus
Atún	Bluefin	T. thynus
Ojo gordo	Bigeye	T. obesus
Bocon	NA	NA
Bonito	Little tunny	Euthynnus alletteratus
Bonito	Atlantic bonito	Sarda sarda
Carite/carito	King mackerel	Scomberomorus cavalla
Carite/carito	Cero	S. regalis
Carite/carito	Unknown	S. brasiliensis
Dorado	Dorado/mahi mahi	Coryphaena equiselis and hippurus
Jurel	Bluntnose jack	Hemicaranx amblyrhynchus and Caranx sp.
Machuelo	Thread herring	Opisthonema oglinum
Marlin	See "pez aguja"	
Peto	Wahoo	Acanthocybium solandri
Pez aguja	Billfish	
Aguja/blanca	Atlantic white marlin	Tetrapturus albidus
Aguja azul	Atlantic blue marlin	Makaira nigricans
Pez vela	Atlantic sailfish	Istiophorus albicans
Pez espada	Swordfish	Xiphias gladius
Picuda	NA	NA
Sábalo	Tarpon	Megalops atlanticus Valenciennes
Sierra	Spanish mackerel	Scomberomorus maculatus
Sierra	King mackerel	Scomberomorus cavalla
Sierra wohoo	Wahoo	Acanthocybium solandri
Tiburones	Sharks	Carcharhinus sp. and others
Aleta negro**	Blacktip	C. limbatus
Cachona**	Bonehead	Sphyrna tiburo
Cornuda**	Scalloped hammarhead	S. lewini
Pardo**	Small tail	C. porosus
Tiburon**	Silky	C. falciformes
Tintorera**	Tiger	Galeocerdo cuvieri
NA	Bignose	C. altimus
NA	Blacknose	C. acronotus
NA	Sandbar	C. plumbeus
NA	Dusky	C. obscurus
NA	Bull	C. leucas
NA	Night	C. signatus
NA	Reef	C. perezi
NA	NA	C. macu
NA	Blue	Prionace glauca
NA	Shortfin mako	Isurus oxyrinchus
NA	White	Carcharodon carcharias
Pacific coast		
Atunes	Tunas	Thunnus sp.
Albacora	Albacore	T. alalunga
Aleta amarilla	Aleta amarilla	T. albacares
Atún	Bluefin	T. thynus
Atún patiseca	Black	Euthnnus lineatus
Barrilete	Skipjack	Katsuwonus pelamis
Ojo gordo	Bigeye	T. obesus
Dorado	Dorado/mahi mahi	Coryphaena hippurus
Machuelo	Thread herring	Opisthonema libertate
Pez aguja	Billfish	
Marlín azul	Indo-Pacific blue marlin	Makaira mazara
Marlín negro	Black marlin	M. indica
Marlín rayado	Stripped marlin	Tetrapturus audax
Pez vela	Indo-Pacific sailfish	Istiophorus platypterus
Pez espada	Swordfish	Xiphias gladius
Puercito	See "pez espada"	

Sierra	Pacific sierra	Scomberomorus sierra
Tiburones	Sharks	Carcharhinus sp.
Aletinegro	NA	Carcharhinus coniceps
Bravo	NA	NA
Gato	Nurse	Ginglymostoma cirratum
Martillo	Hammarheads	Spyma sp.
Tinto/tintoreras	Various*	Carcharhinus sp.
Toyos	Sharks	
NA	Pacific sharpnose	Rhizoprionodon longurio
NA	Smoothhound	Mustelus sp.
NA	Dogfish	Squalus sp.

Note: Colombian authors vary somewhat as to the scientific names designated for various Colombian (Spanish language) names. This is especially true for carite and sierra *Scomberomorus sp.*).
* The genus Carcharhinus encopasses several different species, including spinner, silky, bull, blacktip, oceanic whitetip, dusky, reef, sandbar, and others.
** Most common
NA - Not available
Source: Various

1.2

ECUADOR

Foreign purse-seine and longline fishermen have for years targeted tunas off Ecuador. The foreign longline fishermen also reported swordfish catches. They have historically reported some productive yields in grounds along the southern Ecuadorean and northern Peruvian coast, but have reported more significant swordfish catches in oceanic waters around and to the west and southwest of the Galápagos. The Ecuadorean Government does not allow foreign fishermen to transship through Ecuadorean ports. Several foreign fishermen, however, have signed association contracts with local companies to obtain access to Ecuadorean waters. The associated vessels are required to land their catch at Ecuadorean ports. Ecuadorean fishermen have developed a domestic longline fleet of small vessels targeting tropical tunas and dorado, but have generally reported only limited swordfish by-catches. Swordfish do not appear to be as abundant off the Ecuadorean coast as along the coastal fishing grounds off Chile and Peru. Coastal environmental conditions off Ecuador appear less favorable than the coastal grounds to the south where the cold Humboldt Current is more pronounced, creating ideal conditions for swordfish. More favorable conditions appear to exist in the oceanic waters west of the Galápagos. Little historical data exists on Ecuadorean domestic swordfish catches, although available trade data suggests that there were limited catches during the 1970s. Significant Ecuadorean longline fishing did not begin until the mid-1980s. Fishermen caught about 500 tons of swordfish in 1986-87, but it is unclear as to precisely what vessels were involved. The fishery subsequently declined. Ecuadorean artisanal and semi-commercial fishermen began longlining for tuna and dorado during the mid-1980s. Ecuadorean catches during the 1990s appear to have ranged from about 250-350 metric tons, although the lack of detailed Ecuadorean data makes it difficult to assess catch patterns. Ecuadorean sources report sharply increased swordfish catches beginning in 1994-95, perhaps as high as 500 tons. The authors cannot, however, corroborate the local reports because such substantial catches during those years are not confirmed by export shipments. A few Ecuadorean companies have recently begun deploying longliners to the west of the Galápagos Islands in directed swordfish operations. A powerful El Niño is developing in 1997 and fishermen are reporting varied impacts as a result of the warming water temperatures. Some companies working with artisanal fishermen in largely coastal operations are reporting declining catches of tunas and swordfish, although they continue to land dorado. Other companies conducting more oceanic operations are reporting sharply increased catches. Ecuadorean companies export swordfish mostly to the United States, primarily as fresh product. Export shipments to the United States exceeded $1 million in 1996, a sharp increase over recent years, but still below the record levels reported in 1986-87. Exporters are continuing to increase swordfish shipments to the United States in 1997 and have begun to process small quantities of steaks. The increased shipments are in part due to fleet expansion and the initiation of directed swordfish sets in new grounds to the west of the Galápagos. Some companies are convinced that rising water temperatures in the eastern Pacific associated with the 1997 El Niño are also an important factor. Ecuador also exports to Japan, but these shipments appear to be primarily other billfish. Several companies are especially interested in expanding penetration of the Japanese market. There are also some swordfish exports to the European Union which appear to have increased in recent years. Joint venture activity is limited. There is no known Ecuadorean research specifically on swordfish, although Ecuadorean researchers have initiated some broader studies on tunas and other oceanic pelagics.

ECUADOR: Fishing

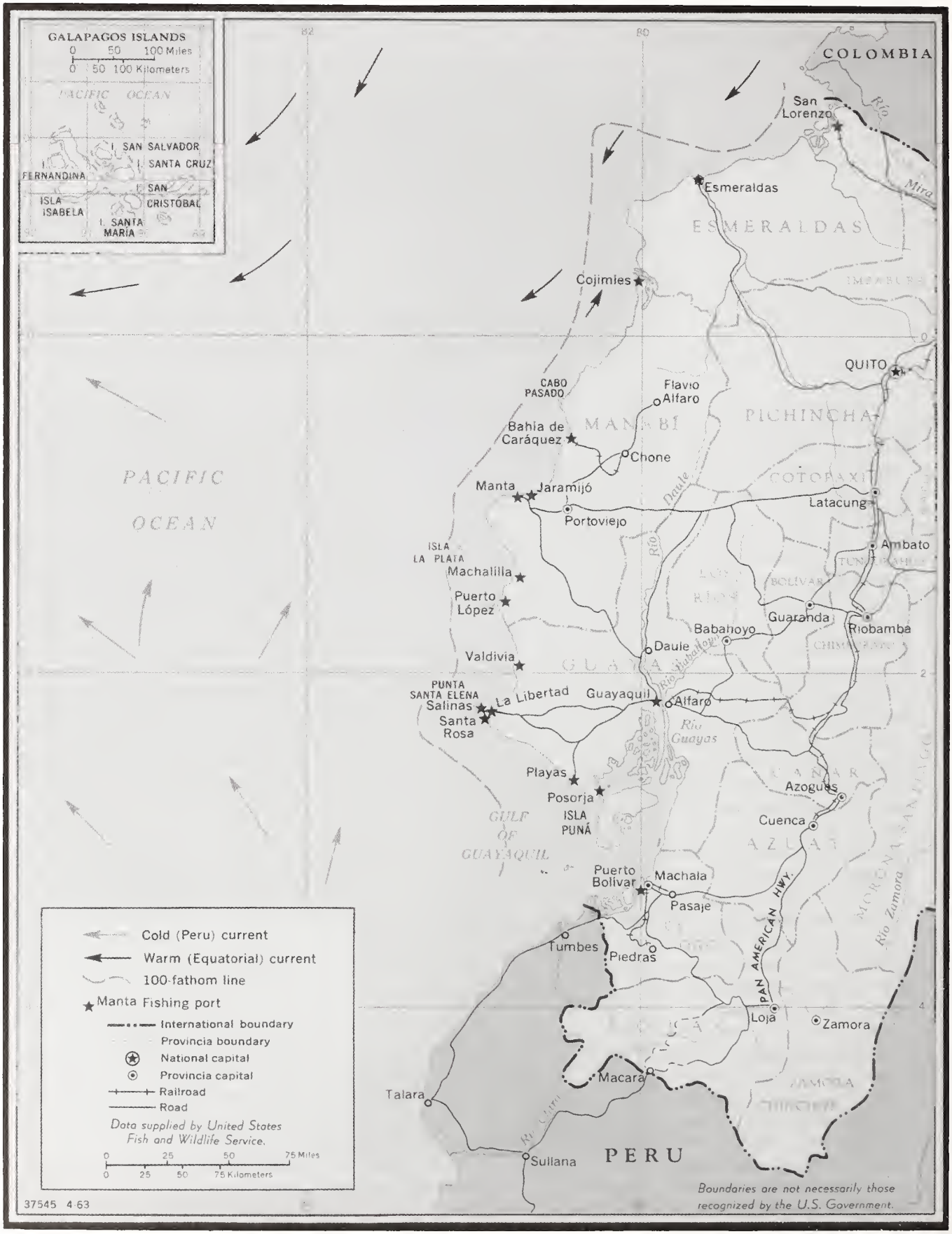

Figure 1.--Map of Ecuador

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I. Fishing Industry Overview

The fishing industry is one of Ecuador's leading economic sectors. Fisheries is an important source of food and employment, and is the country's second most important non-petroleum export commodity, after bananas. The Ecuadorean catch in recent years has declined sharply since peaking at 1.1 million metric tons (t) in 1985 (appendix B1a and figure 2). The catches during 1991-95 were relatively stable at about 0.3-0.4 million tons. Almost all of the decline since 1985 has been due to falling catches of small pelagics which formerly supplied a substantial canning and fishmeal industry. About half of the average catch in the past few years has been tuna and various whitefish (especially popular edible species referred to, locally, as "whitefish" or "pescado blanco") (figure 3). Fishermen also land important quantities of shrimp, tuna, various other finfish, and other species.[1]

Shrimp: Shrimp has traditionally been one of the major Ecuadorean fisheries and currently dominates the industry (photo 1). Shrimp alone accounted for 16 percent of overall Ecuadorean exports in 1994.[2] Much of the current production is harvested by shrimp farmers who have developed one of the world's leading shrimp culture industries. These farmers during the 1980s replaced fishermen as the country's most important shrimp producers.[3] Ecuador produces about $0.5 billion of shrimp annually.

***Photo 1**--As in most of Latin America, shrimp trawlers were some of the first commercial fishing vessels deployed in Ecuador. Dennis Weidner*

***Photo 2**--Ecuadorean companies have traditionally deployed small seiners for tuna, but are now gradually acquiring larger and more modern seiners. Boris Buenaventura*

***Photo 3**--The commercial fishing industry in Manta developed around canneries focused on tuna and sardines. Dennis Weidner*

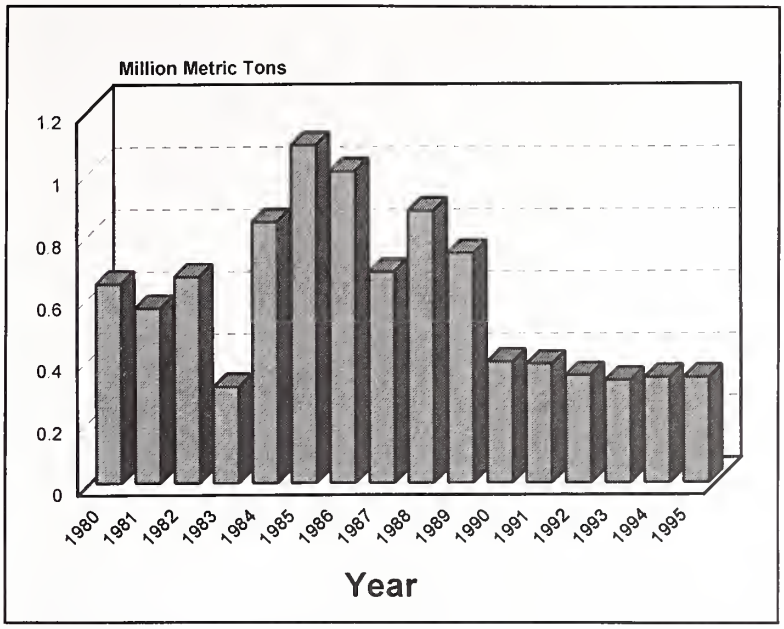

Figure 2.--Ecuadorean fishery catches peaked in 1985 and declined sharply after 1989. Catches since 1990 have been relatively stable.

Small pelagics: A fleet of small seiners target thread herring, sardine, and other small pelagics (photo 4). Most of the small pelagic catch is reduced to fishmeal. Some of the catch also supports a small canning industry. Catches have plummeted in recent years. The decline is probably due primarily to climatic conditions, but some observers believe that over fishing may also have contributed to the decline. The plummeting catch has resulted in sharply lower fishmeal production and exports. The $8 million of fishmeal exported in 1994 was only a fraction of the more than $50 million earned as recently as 1988.[9]

Whitefish: Artisanal fishermen as recently as the early 1980s conducted very primitive operations primarily supplying local markets (photos 6, 9, 26, 33, and 42). The fishermen and companies in recent years have made great progress in producing high-quality dorado and other high-value fish which can be exported.[10] The fishermen setting handlines and small longlines also take tuna as well as some swordfish. Most of the domestic swordfish catch has been taken by these fishermen, but commercial longline fishermen are now increasing swordfish catches. The whitefish has come to rival the tuna purse-seine fishery in importance and whitefish export earnings first surpassed the value of purse-seine caught tuna in 1992.[11] Whitefish exports exceeded $43 million in 1992. The growth of this

Tuna: Tuna is another important Ecuadorean fishery. The fishermen operate one of the larger Latin American tuna fleets. The fleet is composed of mostly smaller vessels which primarily operate in Ecuadorean waters, but fishermen are acquiring larger vessels (photo 2). The tuna fleet in 1992 totaled nearly 60 vessels, only about 7 of which were larger vessels (greater than 400 Gross Registered Tons-GRT) (appendix A4). The fishermen, by 1995, had acquired 36 large vessels, mostly purse seiners.[4] The Ecuadorean tuna fleet landed a total of 48,000 t of tuna in 1996.[5] The number of smaller tuna vessels, including longliners, has also grown during the same period. Part of the tuna purse-seine catch is canned for local consumption and for export to neighboring countries (photo 3). Most of the remaining seiner catch is exported frozen. Unlike several other Latin American fishermen, Ecuadorean tuna purse-seine fishermen do not set on dolphins.[6] As a result, Ecuadorean exporters have continued to maintain their export markets in the United States. Several small boat operators in recent years have deployed longlines to supply high-quality tuna to the Japanese and United States (California) sashimi market.[7] The tuna industry has had an important impact on the Ecuadorean economy, supporting thousands of workers during 1996 and attracting substantial investment capital.[8]

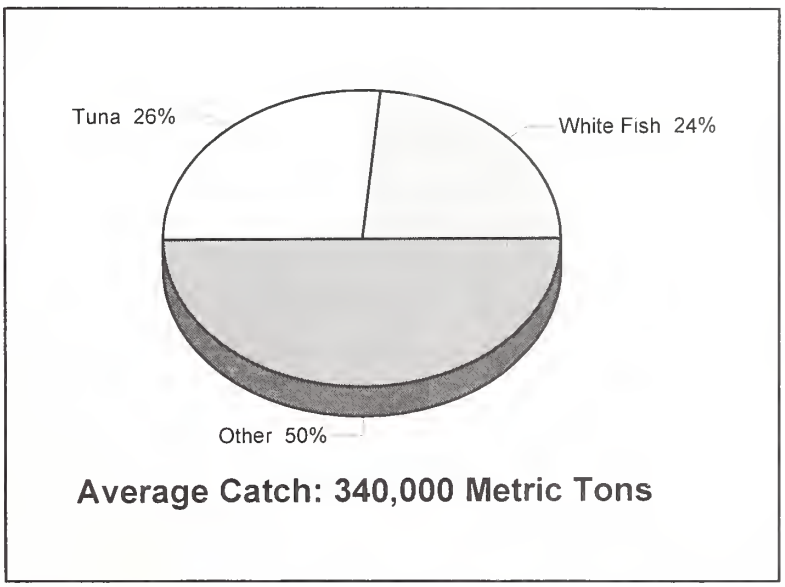

Figure 3.--Half the Ecuadorean catch is composed of tuna and whitefish ("pescado blanco"). The fishermen include several pelagic species (dorado, swordfish, billfish, and sharks) in the whitefish category.

Photo 4.--Seiners target small pelagics although the catch has declined significantly in recent years. Several artisanal longliners can be seen to the left of the seiners. Boris Buenaventura

fishery is due to the expanding artisanal fleet which the Government has promoted in recent years.[12] A total of about 10,000 t of whitefish was exported in 1996 with an approximate value of $54 million.[13]

The Ecuadorean fishing industry developed significantly during the 1980s. Two major developments in the industry enabled Ecuadorean companies to significantly increase seafood exports during the past 10 years.

Aquaculture: The most significant development was the growth of a shrimp culture industry, the largest in Latin America (photo 5).[14] The aquaculture sector now dominates the shrimp industry. Farmers are also beginning culture operations for other species.

Diversification: The country's capture fishing industry has been diversifying in recent years. The former focus on seining for tuna and relatively low-value small pelagics has declined. Artisanal fishermen traditionally conducted primitive operations, producing low-quality product (photo 6). Considerable progress has been made in modernizing the artisanal fishery.[15] In addition, several companies have initiated more advanced semi-commercial operations employing modern longlines and drift gillnets. These companies are now supplying important quantities of high-quality fresh and frozen finfish, including swordfish, to export markets.[16]

Ecuador has become one of the leading Latin American exporters of fishery products. Export shipments of fishery products have soared during recent years, nearly tripling from only $0.2 billion in 1980 to nearly $0.6 billion in 1991 (Latin America, appendix E1). This increase has been primarily due to the expanding shipments of farmed shrimp (photo 7).

Exports: Fishery commodities are some of Ecuador's principal export products. The fishing industry is among the nation's fastest growing sectors, with exports increasing 15 percent in value during 1994.[17] The increase since 1985 has been especially striking. Shipments in 1994 totaled nearly $725 million, a 200 percent increase over the $250 million exported in 1985 (Latin America, appendix E1). Notably the value of exports is increasing much more rapidly than the quantity, even discounting inflation--confirming that the industry is increasingly focusing on higher value product.

Crustaceans: The principal fishery export commodity is frozen shrimp and shipments of fresh, frozen, and cured crustaceans (mostly frozen shrimp) totaled nearly $450 million in 1993, almost 80 percent of all fishery shipments in that year. These shipments increased to nearly $540 million in 1994, about 75 percent of all fishery shipments.

Finfish: Through the mid-1980s, much of Ecuador's finfish exports were canned product (photo 8). Shipments of fresh and frozen finfish totaled slightly more than $75 million, or 13 percent of total 1993

***Photo 5**--The shrimp culture sector which developed during the 1980s now dominates the country's shrimp industry. Dennis Weidner*

shipments. While still only a small part of total fishery exports, finfish shipments are expanding. In 1994 shipments of fresh and frozen finfish increased nearly 50 percent to $110 million. Finfish exports are one of the fastest growing sectors of the industry. Finfish shipments totaled less than $20 million as recently as 1985, but the growth through 1994 has totaled more than 430 percent. The primary finfish export commodity has been frozen tuna imported by foreign canneries. Shipments of high-quality fresh and frozen fish (tunas, especially bigeye, billfish, dorado, and shark, as well as small quantities of swordfish) are now becoming increasingly important. The growth rate for tuna commodity exports during 1994 was greater than for all other fishery commodities. **Imports:** Ecuador does not import significant amounts of seafood due to the limited local demand and generally low personal incomes. Seafood prices tend to be relatively low in Ecuador, attracting little interest on the part of foreign exporters. (See "Market/Local".) Ecuador imported only about $9 million of seafood in 1994, while seafood exports totaled more than 75 times that amount! There are no known tuna or swordfish imports.

***Photo 6**--Many artisanal fishermen, even in the 1980s, conducted primitive operations. Their catch was often processed in unsanitary conditions on the beach. Dennis Weidner*

Photo 7.-- Cultured shrimp is Ecuador's principal fishery commodity and export shipments annually earn about $0.5 billion. Dennis Weidner

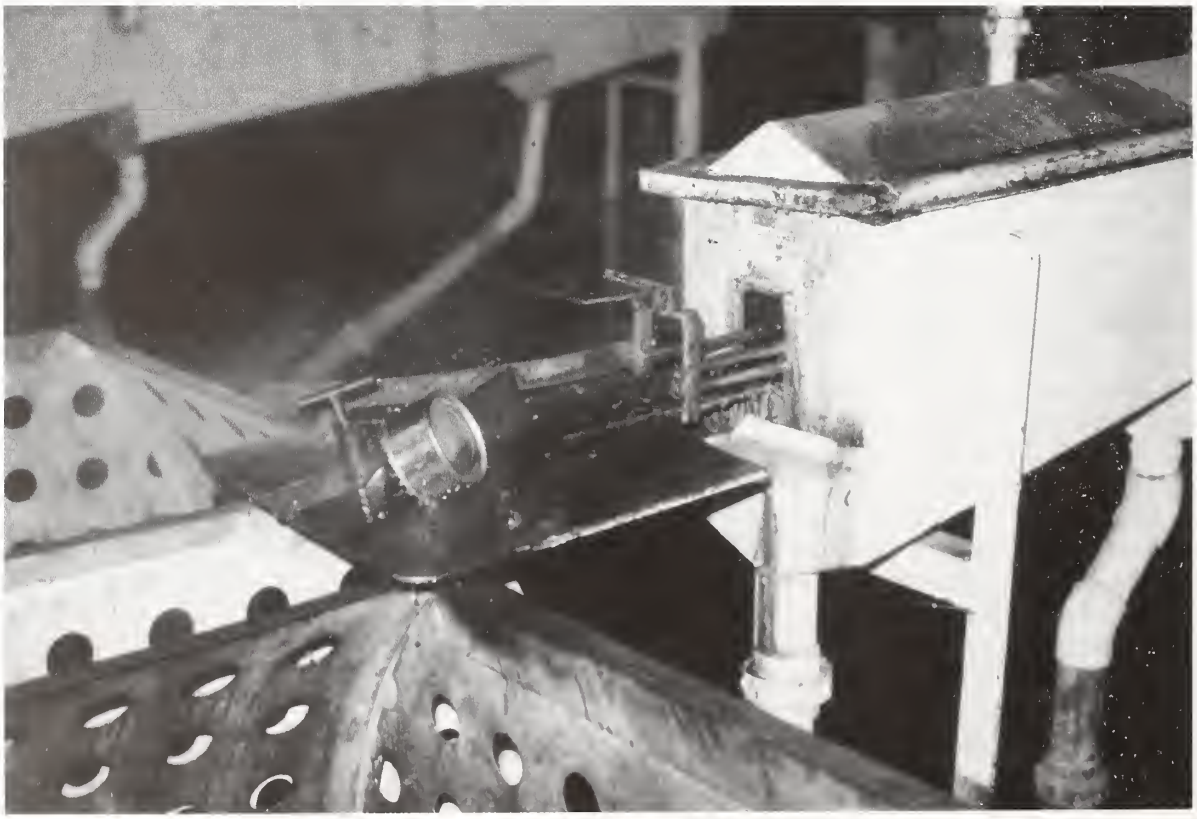

Photo 8 --Most of Ecuador's finfish exports during the 1960s, 70s, and early 80s were canned product. Dennis Weidner

II. Species

A. Stock structure

Swordfish are known to occur off Ecuador, both within and beyond the country's 200-mile Territorial Sea (TS).[18] Few actual studies, however, are available on the stock structure and relationship to other Pacific populations. The authors have little hard evidence on swordfish stock structure off Ecuador, but there are reasons to believe that the population is part of a southeastern Pacific stock which extends south along the Chilean and Peruvian coasts and into adjacent ocean areas. No tagging studies exist to confirm this relationship.[19] Several other factors, however, suggest the likelihood that the fish along the South American Pacific coast are all part of the same population, although the authors stress the available evidence is not conclusive. The theorized southeastern Pacific stock may be separate, but it is not isolated from the wider pan-Pacific stock which includes fish found in the northern and western Pacific. Biologists continue, however, to be uncertain about the stock structure of Pacific swordfish and considerable discussion on the issue continues.[20]

Several factors suggest the possibility that swordfish in the southeastern Pacific are a single, common stock:

Oceanography: The Humboldt Current creates a coherent large marine ecosystem (LME) off the western coast of South America. Fishery-related data suggest that swordfish in some areas follow current flows for at least part of the year.[21] The Humboldt Current is strongest off Chile and Peru and weakens considerably by the time it reaches Ecuador. As a result, there are significant seasonal fluctuations in the strength of the current (figures 4 and 5). (See "Fishing Grounds".) The limited swordfish catch off Ecuador suggests that only a small proportion of the Chilean population follows the Humboldt Current as far north as the Ecuadorean waters.[22]

Catch patterns: An assessment of catch patterns provides some support for the theory that swordfish off Ecuador are part of a single stock which ranges south as far as central Chile, although the available evidence is far from conclusive.

Seasonal: The lack of detailed Ecuadorean catch data makes it difficult to assess catch patterns. (See "Seasonality" below.) In addition, the apparent seasonality of swordfish catches may be related more to the impact of adverse weather conditions which inhibit fishing effort rather than actual abundance. This may be especially true of the Ecuadorean fleet which uses relatively small boats that cannot be deployed in rough ocean conditions. The generally rougher seas from June to November often restrict operations, especially in offshore areas. Thus the fish

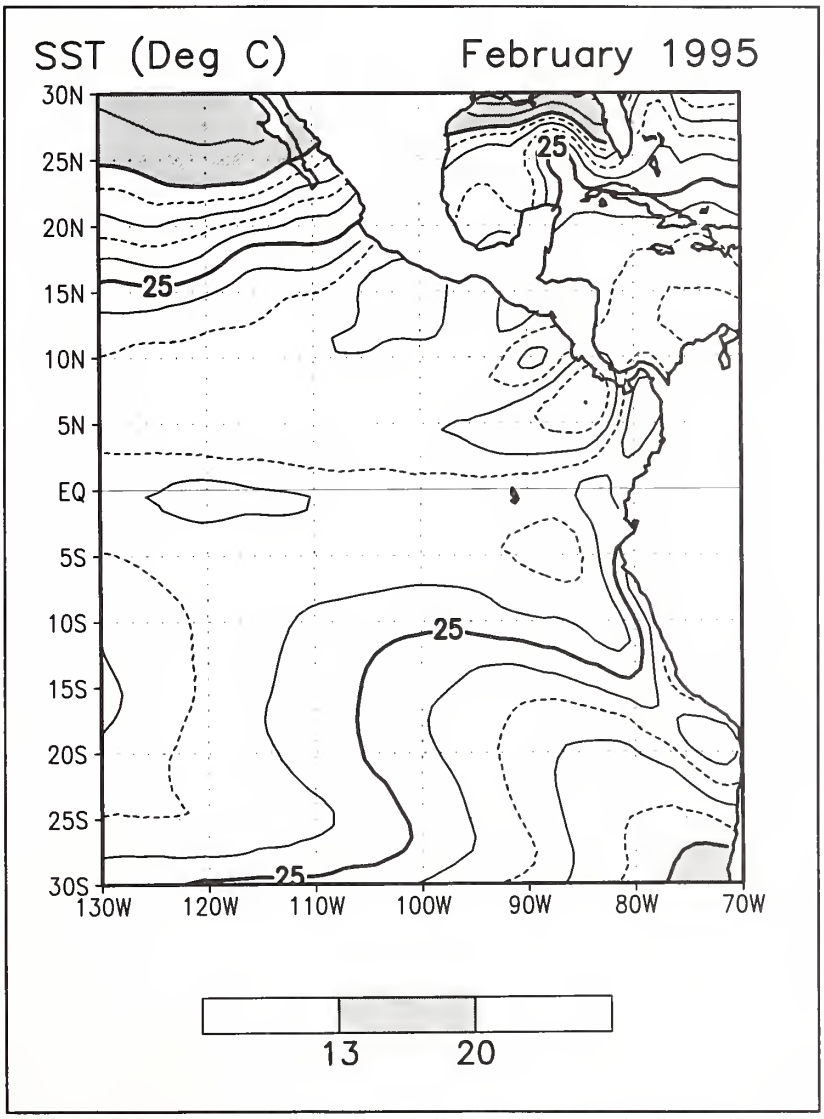

Figure 4.-- The Humboldt Current is generally most pronounced off Ecuador at the beginning of the year. Vernon Kausky, NOAA

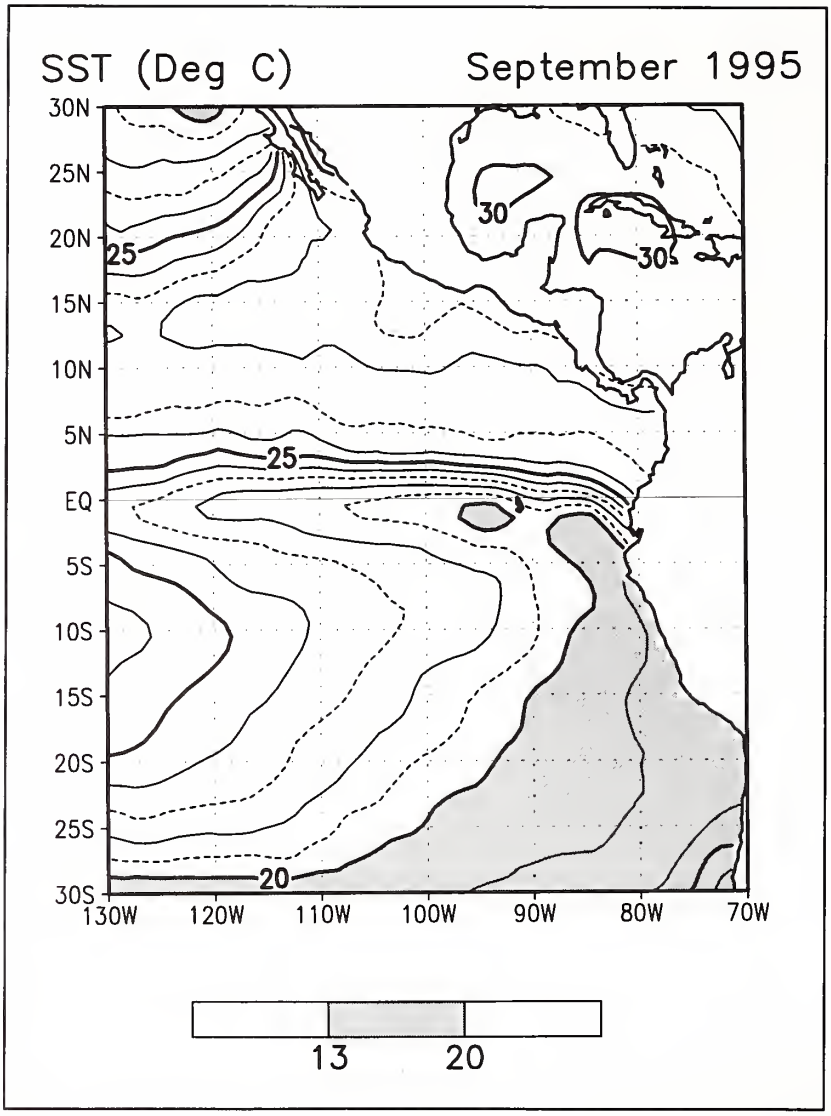

Figure 5.-- Thermal fronts to the west of Columbia and Ecuador are often pronounced during the second half of the year. Vernon Kausky, NOAA

may be present, but the fishermen are unable to deploy their lines or even leave port.[23] Foreign longline data is available, although it is compromised in terms of assessing swordfish trends because the target species was primarily bigeye tuna. The available data suggests that abundance in coastal waters off Ecuador and northern Peru appears to be less seasonal than in coastal waters off southern Peru and Chile.[24] Although the seasonal fluctuations are less marked, there appears to be an inverse relationship with the abundance reported off Chile. The fish off Ecuador and northern Peru are most abundant during the first quarter in the year.[25] (See "Seasonality" below.) This is the season when swordfish are not abundant off Chile (Chile, appendix E2c1-2).[26] This inverse seasonal relationship, while weak, suggests the possible migratory movement of a common stock. The authors note, however, that seasonal patterns reported by foreign longline fishermen in the equatorial latitudes of the eastern Pacific are highly varied.[27] It is thus difficult to discern pronounced patterns and the authors stress that foreign seasonal swordfish catch data is especially suspect as the fishery targeted tuna.[28]

Annual: Limited Ecuadorean catch data makes it difficult to compare annual results with Chile to determine if annual fluctuations are related.[29] If fluctuations were related, it would support the contention that swordfish in the southeastern Pacific are a separate stock, although the authors note that even within the range of coherent stocks, fishermen have reported localized patterns of abundance. Data submitted by Ecuador to FAO and NMFS estimates (based on imports from Ecuador) suggest catches have declined during 1992-93 (appendix B2a).[30] This would correspond with the significant declines reported off Chile after 1991 (Chile, appendix E2a1),[31] supporting the single stock theory. Recent data supplied to the authors by the INP (appendix B2b2), however, suggest very significant Ecuadorean catch increases since 1994, which would question the relationship between the fish off Ecuador and Chile. The increase since 1994, however, appears to have been caused by opening a new fishery and grounds rather than fluctuating results in an existing fishery.

Geographic: Japanese and other distant-water longline fishing patterns show a distinct clustering of catches and high yields in the southeastern Pacific (figures 6-8). These patterns strongly suggest the existence of a relatively, but not completely, isolated southeastern Pacific population.[32] This clustering is important evidence of a separate population and unlike seasonal data, is not as tainted by the fact that swordfish were not the primary target of the Japanese and other foreign longline fishermen.[33] The reader should note that the Japanese report a similar clustering of the target species (bigeye tuna) in the southeastern Pacific.[34] Thus it is possible that the swordfish cluster may in part be a reflection of a more intense effort. The available swordfish yield data also shows

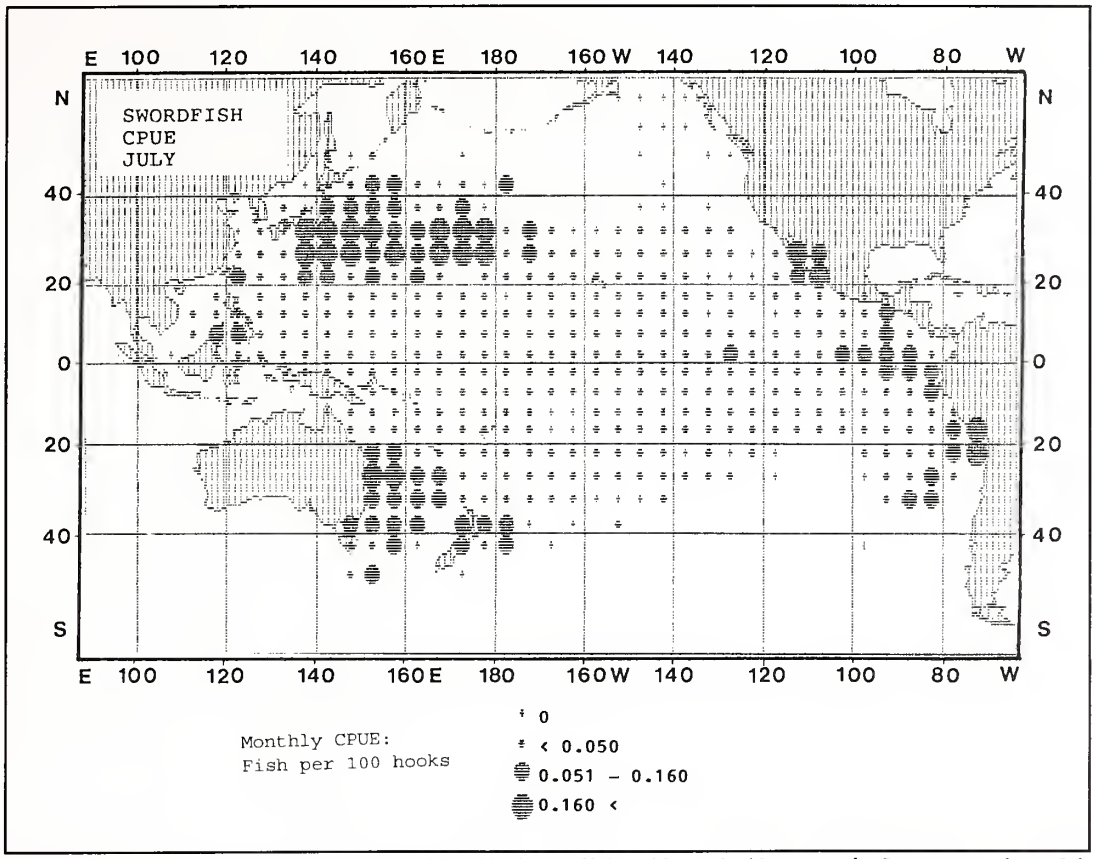

***Figure 6.**-- The Japanese report that historic (1952-1985) swordfish yields are highly seasonal. Compare results in July with October results (figure 7). Sosa and Shimizu*

a southeastern cluster.[35] This suggests that it is not merely a reflection of more intense effort aimed at bigeye.

Genetics: Some preliminary genetic studies based on comparisons between swordfish samples from Ecuador and Chile to other Pacific fish have found little genetic diversity between the Ecuadorean and Chilean fish, but significant diversity with other Pacific fish. This suggests that the fish off Chile, Peru, and Ecuador are part of a single stock separate from swordfish in the wider Pacific.[36] This conclusion, however, is still tentative and not shared by all genetic researchers. A Japanese geneticist, for example, using different methods from the U.S. research group has not found evidence confirming a separate southeastern Pacific stock.[37]

B. Migrations

The authors have no available information on swordfish migrations off Ecuador. There are no tagging studies. Swordfish appear to be present in commercial quantities off Ecuador all year round, but Japanese longline yields suggest modest seasonal fluctuations, with populations peaking from August through December (figure 7).[38] Notably, this is a period when swordfish off Chile become increasingly less abundant.[39] The close correspondence of offshore yields to seasonal patterns off Chile suggests that fish off Ecuador could be part of a migratory movement of a theorized southeastern stock. Such migratory movements, however, are unclear. Notably, swordfish are generally not abundant in some areas between Ecuador and Chile, especially the north central Peruvian coast.[40] The authors stress that plotting possible migration tracks by assessing seasonal data is tenuous, especially because the most complete data sets come from the foreign tuna longline fishery in which swordfish is not the target species.[41] Given the time constraints, the authors have assessed available evidence for possible insights into migratory patterns, but stress the findings are meant to only suggest possible scenarios for future assessment when better data is compiled and tagging studies can be carried out.

Genetic studies suggest some mixing of southeastern Pacific and the wider pan-Pacific stock in the waters off the United States (California) and Mexico (Baja California). Swordfish taken off California and the Baja show a mixed genetic pattern. The migratory track of the southeastern stock to and

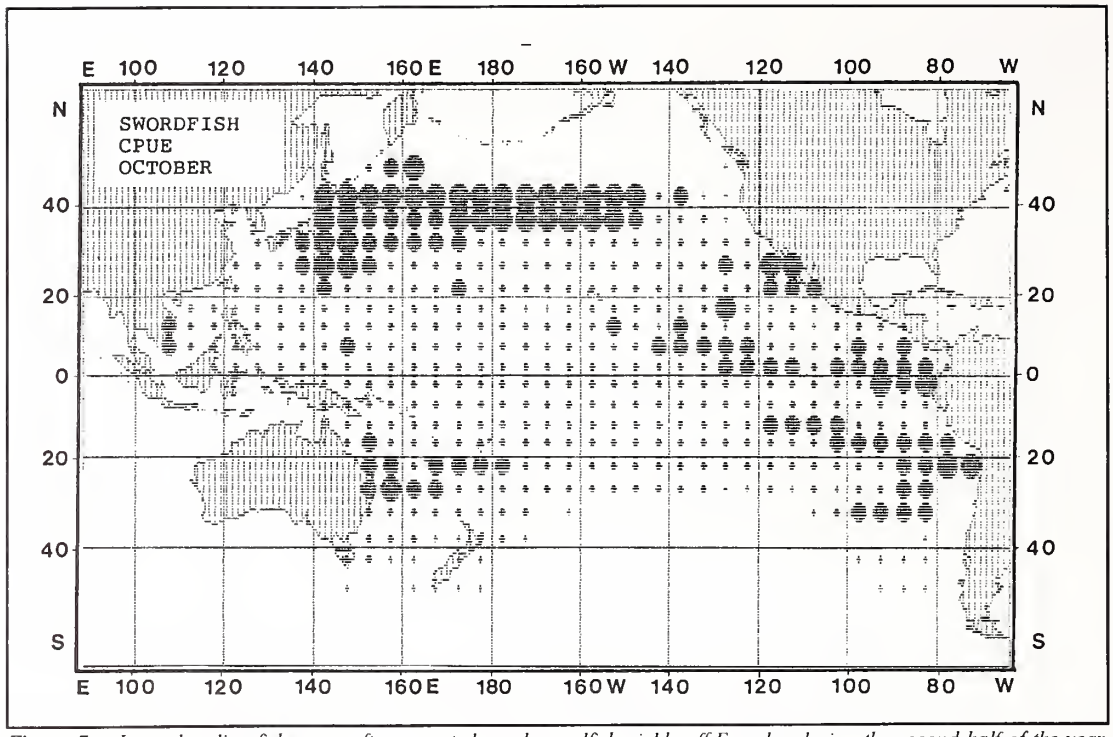

Figure 7.-- Japan longline fishermen often reported good swordfish yields off Ecuador during the second half of the year, especially during September and October. Sosa and Shimizu

from the Baja, however, is unknown. Swordfish may not migrate all the way from Chile to the Baja. Fish in the southeastern Pacific probably do not have one single migratory track. As U.S. researchers note little genetic diversity between Ecuadorean and Chilean samples, interactions appear to be mostly to the south with the fish off Chile rather than off the Baja. The genetic mixing found off the Baja, however, suggests some limited exchanges northward. It could be that some southeastern Pacific swordfish are less migratory than others.

There are several possibilities to explain swordfish movements.

Within the southeastern Pacific: The fish off Ecuador and northern Peru and in oceanic equatorial waters may have a different migratory track than the fish off Chile and southern Peru. All of the fish may spawn in the same oceanic equatorial waters, explaining the apparent lack of genetic diversity in the southeastern Pacific. Such scenarios, however, are only speculative at this stage.

Exchanges with wider-Pacific stock: It is unclear how the interactions between the southeastern and

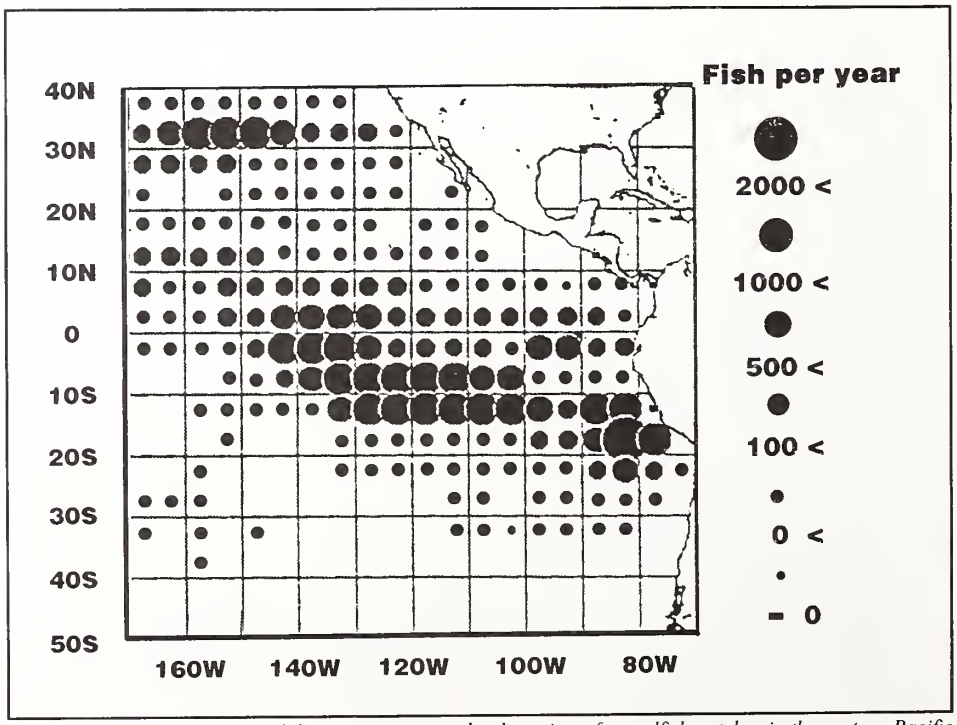

Figure 8.-- Japanese longline fishermen report a tight clustering of swordfish catches in the eastern Pacific during the 1990s. Uozumi and Yokawa

wider-Pacific stock occur. The seasonal pattern suggests some fish move north along the Central American coast.[42] The extent of such movement appears limited. Available catch and effort data indicate generally small swordfish catches and low yields off much of Central America and southern Mexico.[43] This suggests that the possibility of other migratory paths in oceanic areas. Available catch and yield data show that swordfish occur throughout the eastern Pacific and that exchanges are also possible in offshore areas.[44] Some data shows that catches in certain offshore areas are seasonally significant, suggesting the possibility of offshore fish movements and thus exchanges.[45]

C. Spawning

No information is available on the maturation of swordfish off Ecuador. Spawning patterns can be inferred based on the presence or absence of larvae. Foreign researchers, from both distant-water and neighboring coastal countries, have noted the absence of larvae in the eastern Pacific which suggests that the fish are not spawning in the area. One Ecuadorean researcher, however, reports that Ecuadorean plankton studies have detected a few swordfish larvae.

Foreign research: Available plankton studies by distant-water countries and the United States off its Pacific coast have so far found no swordfish larvae in the eastern tropical Pacific (ETP), east of 108°W.[46] While the research effort in the ETP has been more limited than in the western and central Pacific, the available evidence suggests that the fish do not spawn off the Ecuadorean coast. Scattered larvae have been found west of 108°W which would be about 300 kilometers (km) west of the Galápagos. The most comprehensive plankton study was conducted by the Japanese National Research Institute of Far Seas Fisheries (NRIFS). The Japanese researchers found increasing quantities of swordfish larvae at 10-12°S, which would be latitudes off northern Peru, but south of Ecuador. Unfortunately NRIFSF did not conduct tows south of 12°S, so the spawning area for the theorized southeastern Pacific stock is unclear.[47]

Neighboring country research: Neighboring countries (Colombia, Peru, and Chile) have also reported an absence of swordfish larvae in the eastern Pacific.[48] Researchers in these countries (especially Colombia and Peru) have not been looking specifically for swordfish and thus it is possible that this may have affected results of their plankton studies. Still no swordfish larvae have been reported to date.

Ecuadorean research: Ecuadorean researchers through 1994 never encountered swordfish larvae. Researchers report, however, that in one 1995 plankton study focusing on small pelagics that a few swordfish larvae were found in the Gulf of Guayaquil (81-82°W).[49] This is the only ETP report of swordfish larvae know to the authors. The authors do not yet know if this was an anomaly. There are no other Ecuadorean reports of swordfish larvae to corroborate the presence of swordfish larvae. Another 1995 experiment studying tuna in waters between the Galápagos and the Ecuadorean coast (81°-90°W) found large quantities of albacore larvae, but failed to find swordfish larvae.[50]

D. Seasonality

The authors have no Ecuadorean data on swordfish seasonality. Some fishermen have offered anecdotal accounts. Other insights into seasonality are available from foreign fishing data and export trends. These various sources, however, describe substantially different seasonal patterns. To some extent this may be explained by differences in fishing grounds, strategies, and vessels. The authors note, for example, that the Ecuadorean fleet recently initiated directed swordfish sets on offshore grounds during 1996. Such shifting strategies and grounds can significantly change the seasonality of catches. The discrepancies and differences in the available data sets make it impossible to reach any firm conclusions at this time.

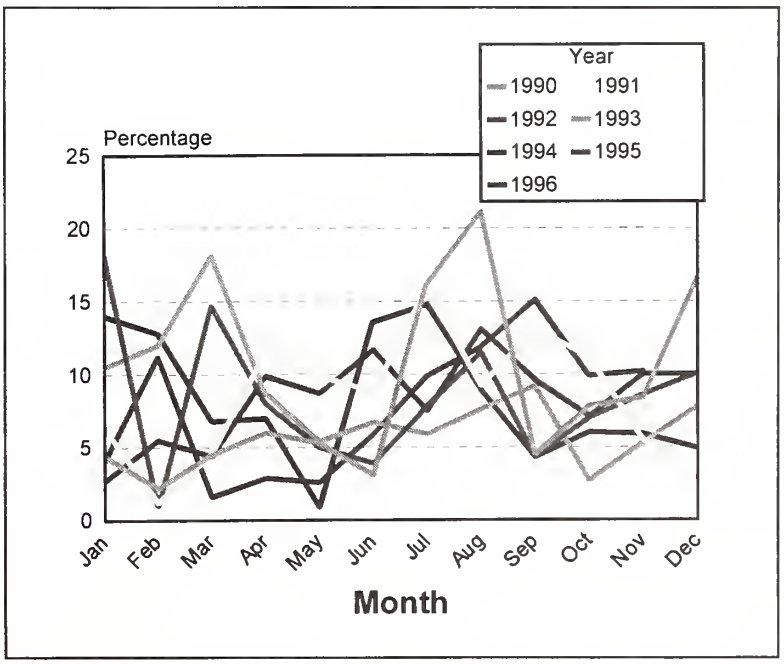

***Figure 9**.--U.S. fresh swordfish imports from Ecuador are highly variable and it is difficult to detect any discernable seasonal pattern in landings.*

Ecuadorean reports: The authors do not have actual Ecuadorean seasonal swordfish catch statistics to assess catch patterns. Ecuadorean fishermen have only recently begun directed swordfish operations. Catches before 1996 were almost entirely incidental to directed tuna operations. In addition, the fishermen have shifted grounds and are beginning to operate on new grounds west of the Galápagos, where swordfish appear to be most abundant. Operations west of the Galápagos are conducted primarily from December through May. As a result, current Ecuadorean swordfish catches are reportedly highest during this period.[51] The authors note, however, that the seasonality of catches and yields may be related more to the impact of ocean conditions limiting fishing pressure rather than the seasonality of swordfish abundance itself. The relatively calm ocean conditions reportedly prevalent during December to May allows the small Ecuadorean longliners to safely reach and operate in the area. During the rest of the year (June through November), fishing pressure decreases in the grounds west of the Galápagos because rough ocean conditions make it more difficult and dangerous for the smaller longliners to operate at any distance from the coast.

Foreign catch data: Japanese longline data from grounds off Ecuador suggests a sharply different seasonal pattern. The authors stress the limitations of the Japanese data as it comes from a fishery targeting tunas. Japanese longline catch data from 1952-85 show that yields are best in coastal waters from August through December (figures 6 and 7). In addition, the offshore fishery out to 130-140°W at latitudes off Ecuador shows the best yields from October through January.[52] This seasonal pattern corresponds closely to the period in which the Chilean catches (1986-95) and yields begin to decline off northern Chile and begin to increase again (March) off southern Chile.[53] The Japanese longline shows the southern Peruvian and Chilean yields beginning to increase in April and May.[54] This data, however, must be assessed with caution. More current Japanese catch data show that the best catches west of the Galápagos are taken in the second half of the year, especially July-September although the pattern changes dramatically further west.[55] This pattern is sharply different along the coast and in the waters between the coast and the Galápagos. Catches along the coast are best during the beginning of the year. Between the Galápagos and the coast catches are best during the middle of the year from April through September.[56]

Export trends: Most of the Ecuadorean swordfish catch is exported fresh to the United States. (See "Markets.") As a result, the seasonal export trends correspond closely to catch trends. U.S. trade data, however, show a highly mixed pattern with substantial monthly variations (figure 9). During the 1990s, shipments have generally, with the exception of 1992-93, been highest during the second half of the year. Some of the best months are often June-August and December-January (appendix D2h and figure 9).

E. Weight

The authors have limited information on the weight of the swordfish being landed by the commercial and semi-commercial longliners operating off Ecuador. One local observer, however, who owns a Manta-based company which is affiliated with a foreign longliner, reports that the average swordfish dressed weight ranges between 35-45 kilograms.[57] The authors cannot confirm how representative this is of the sizes taken by other Ecuadorean and foreign longline fishermen. It does appear to be quite similar to the results reported by Chilean longline fishermen who averaged about 40 kilograms (kg) in 1994-95 (Chile, appendix B5c6). The other major species targeted by longliners off Ecuador is bigeye. According to a local observer, bigeye caught in the fishing grounds west of the Galápagos (ranging from 32-45 kg) is smaller than fish caught east of the Galápagos (45-110 kg).[58]

F. Distribution

Many observers beginning in the 1930s have noted the presence of swordfish in the eastern Pacific on both coastal and offshore grounds. One Chilean study of the eastern Pacific longline fisheries beyond the Chilean, Peruvian, and Ecuadorean 200-mile zones reported a swordfish by-catch along with the tuna catch.[59] The catch results of Japanese longline fishermen also substantiate that the fish are present in commercial quantities. Japanese swordfish catches, which in part reflect actual abundance, have varied substantially from year to year, but at least some fishing has been reported from Colombia south to Chile.[60]

Japanese longline fishermen have compiled the most extensive data base. Different assessments of this data all show a distinct clustering of yields and catches in the southeastern Pacific, with some variations in the precise distribution and seasonal patterns involved. This could in part be due to variations in the assessments, such as the use of catch or yield data and the varying time periods covered. The fact that swordfish is not the target species is another problem. Despite these limitations, the authors do not believe that the Japanese data should be discounted. The Japanese catch data during the

1990s show that the best catches were reported off southern Peru, but some good catches were reported off Ecuador. The Japanese catch data suggests that the best swordfish catches off Ecuador were reported on the grounds around the Galápagos Islands.[61] Japanese yield data from 1952-92, however, shows good results off Ecuador and Peru, but the best yields off northern Chile.[62] An FAO assessment of longline catches during 1991-93 showed good swordfish fishing in coastal areas off Ecuador/northern Peru, but the best results off southern Peru.[63]

Ecuadorean fishermen have made some anecdotal comments to the authors on swordfish distribution. Many observers are convinced that swordfish are not abundant in Ecuadorean coastal waters. One local fisherman, for example, maintains that swordfish are not present in great numbers off Ecuador and catches are incidental. He stated that the weakness of the northerly flowing cold Humboldt Current by the time it reaches Ecuadorean waters limits swordfish abundance/catches in the area.[64] Recreational fishermen, even those interested in swordfish, have not reported taking the species off Ecuador.[65] Other fishermen believe that the species is more abundant and that limited catches in the past are due to the lack of directed effort. Several fishermen have acquired larger vessels and initiated directed fishing operations in recent years, in particular targeting grounds to the west of the Galápagos. (See "Fleet Operations and Gear.")

G. Other

Given the limited extent of directed swordfish fishing, Ecuadorean fishermen report few details on swordfish behavior off Ecuador. One Ecuadorean observer, however, reports that the limited swordfish catch is mainly taken during full moon phases.[66] A similar phenomenon has been noted in swordfish fisheries off Chile, the Hawaiian Island, and other areas.

H. Stock status

The authors have no Ecuadorean data on swordfish abundance. Although Ecuador's small research community has done some work on tuna, little work has focused on swordfish (See: "Research.") Catch data suggests that swordfish catch rates off Ecuador are actually increasing despite major declines registered off Chile and moderate declines reported by Japanese distant-water fishermen in the southeastern Pacific. The authors caution that fisheries-dependent data is not necessarily a good indicator of stock status because other factors such as fishing strategy, effort, grounds, oceanographic fluctuations, market trends, and other factors can affect catches. Very little other data, however, is available.

Research: The authors have been unable to identify any Ecuadorean research on swordfish addressing stocks or describing the species behavior. The Instituto Nacional de Pesca (INP), however, is currently conducting an assessment of swordfish abundance and catches, focusing on different biological parameters.[67]

Domestic fishermen: Local observers report that swordfish catches have been declining since the early 1990. Some attribute the decline to changes in environmental conditions.[68] Such reports, however, primarily described fluctuations in the by-catch from directed tuna fisheries. It is difficult to assess trends from available catch and trade data because of discrepancies between available sources (appendix B2a). The most recent reports from the INP indicate major catch increases during 1994 and 1995. The 1994-95 increases are not confirmed by U.S. import data. The U.S. data does show a major increase in 1996 (appendix D2a). While the available data is somewhat contradictory, it clearly does not show any major decline in stocks off Ecuador. The most recent data in fact shows improved results, although this may be due to changes in fishing strategy and grounds rather than resource trends.

Foreign fishermen: Currently only two countries besides Ecuador are heavily fishing swordfish in the southeastern Pacific, Chile and Japan. The Spanish are taking smaller amounts.

Japan: Japanese stock assessments in the southeastern Pacific as a whole suggest that yields have declined since the mid-1970s--but are well above the extremely low levels reported in 1983.[69]

Chile: Chilean researchers have not yet made any stock assessments, but are conducting needed preliminary research for future assessments. The Chileans have, however, reported very dramatic catch declines since the fishery peaked in 1991, suggesting possibly serious resource problems.[70]

Spain: The authors have no data on Spanish assessments, but notice that Spanish fishermen withdrew from the Pacific in 1994. This probably suggests that the fishermen concluded stocks were declining or oceanographic conditions were unfavorable, but other factors may have been involved.[71] A few Spanish vessels returned in 1996 (Peru, photos 36-46).[72]

III. Fishing Grounds

A. Oceanography

Ecuador has the smallest coast line of the four Pacific-coast South American countries. The country is located at tropical latitudes (2°N-3°S). The marine fauna predominating are thus mostly tropical species, although seasonal intrusions of cold water supplied by the Humboldt Current provides some degree of diversity, especially along the southern coast. Species distribution is affected by the Carnegie Ridge jutting outward from the country's central coast. The ridge forms the southern limit of the Panamanian Basin. The generally warm water temperatures within the Basin mean that the marine fauna is composed of tropical species, largely common stocks shared with neighboring Colombia.

The Galápagos Islands (Archipiélago de Colón) located about 1,000 km off the coast (O°, 90°W) are part of Ecuador. The Galápagos are located at the intersection of the Cocos Ridge running southwest from Costa Rica and the Carnegie Ridge running west from central Ecuador.

Fisheries productivity off Ecuador is much more limited than off its southern neighbors, primarily because of the shorter coast and the much more limited coastal upwelling. The shelf is narrow along most of the coast, except for an extensive area in the Gulf of Guayaquil. The fisheries catch can fluctuate significantly, in part due to the varying impact of the northerly flowing Humboldt Current and related periodic oceanic events known as El Niño.

Shelf: As with other Pacific coast countries in South America, the Ecuadorean shelf is fairly narrow, extending only 25-100 km offshore. The most significant shelf area is along the southern coast in the Gulf of Guayaquil.

Upwelling: Ecuadorean fishermen conduct small pelagic fisheries along the southern coast. Small pelagic populations there are supported by coastal upwelling. Ecuadorean fishermen have, as a result, reported catches exceeding 1 million tons. The world's strongest upwelling system is located along the western coast of South America. The system extends from 40°S into the equatorial latitudes off Ecuador where it blends into the equatorial upwelling belt.[73] The upwelling, however, is much stronger to the south, explaining the massive small pelagic catches reported by Chile and Peru.

Currents: The waters off Ecuador are a mixing area created by the confluence of the northerly flowing Humboldt Current and the easterly flowing North Equatorial Counter Current (Colombia, figure 10).[74]

Humboldt Current: The Humboldt Current flows north along the western coast of South America. The strength of the Humboldt Current off Ecuador is highly variable giving rise to significant fluctuations in SSTs off Ecuador (figures 4 and 5). Ocean conditions are also periodically affected by warm water anomalies referred to as El Niño events. During an El Niño event the intrusion of warm equatorial water and other climatic factors can limit the strength of the Humboldt Current off Ecuador and significantly reduce upwelling. As a result, oceanographic conditions off Ecuador are highly variable, giving rise to substantial fluctuations in the quantity of annual fishery catches (especially small pelagic species) as well as the species mix.

North Equatorial Counter Current: This is the second most important eastward flow in the equatorial current system. It is an easterly flowing current which is fed by the western boundary currents both from the south and the north. Its annual mean transport decreases uniformly with longitude, from 45 Sverdrup (Sv--cubic kilometers per second) west of 135°E to 10 Sv east of the Galápagos Islands. As it approaches the Central American shelf, the current turns north, creating a cyclonic motion which causes a relatively shallow thermocline. In the termination region of this current, this effect is known as the Costa Rica Dome (9°N, 88°E) (Colombia, figure 12).

South Equatorial Current: The major westward component of the southern equatorial current system is the South Equatorial Current. This current is directly wind-driven and therefore responds quickly to variations in atmospheric conditions. It is also very seasonal, and is most pronounced during the southern hemisphere winter, when the trade winds are strongest. The South Equatorial Current is strongest in August when it reaches speeds of 0.6 m per second. This current moves water westward from the ETP.[75]

Oceanographic events: Periodic El Niño events, or the intrusion of abnormally warm waters into the ETP, have major impacts on fisheries. The warm water significantly reduces the primary productivity, affecting populations of small pelagic species and other stocks. As a result, Ecuadorean fishery catches have fluctuated widely. Catches since 1985, for example, have ranged from 1.1 million t (1985) to 0.3 million t (1993) (appendix B1a). These large fluctuations in populations of fodder species may have major impacts on the populations and distribution of oceanic predators such as swordfish. A particularly powerful El Niño is developing in 1997 (Chile, figure 26).[76]

Oceanic conditions and long term climatic trends significantly affect swordfish populations and distribution. One of the most significant factors appears to be water temperature, although the existence of thermal fronts may be a more important factor than absolute temperatures. Other phenomenon are upwelling and thermocline depths, factors also associated with temperature, which may affect swordfish. Bottom topography is another possible factor.

Temperatures: Swordfish occur in temperatures from 13°-24°C, but the most productive fisheries are reported in the cooler temperate waters, between 18-23 °C. The warm water found off Ecuador may be at the upper range of temperatures suitable for the species (figures 4 and 5). Most swordfish fisheries are conducted at more temperate latitudes.[77] Very substantial populations of tropical tunas, however, are found off Ecuador, explaining why the longline fishermen primarily target these species. The best Ecuadorean swordfish grounds are reportedly located about 30-130 km west of the Galápagos Islands. According to a local observer, the presence of cooler waters in this area is the main reason for the increase in swordfish abundance, in comparison with other grounds within the Ecuadorean TS.[78] Researchers caution, however, that swordfish is a mesopelagic species and it is not yet clear how they are affected by surface temperature fluctuations.

Thermal fronts: Swordfish appear to be most abundant in areas with sharp temperature gradients. These areas are most commonly found near upwelling areas, zones where various water masses converge, or along pronounced ocean currents. As a result of the convergence of the Humboldt Current and the North Equatorial Counter Current, significant ocean thermal fronts are often encountered in Ecuadorean waters and ocean areas to the west and southwest of the Galápagos (figures 4 and 5). This in part explains why swordfish are taken in significant quantities, despite the tropical water temperatures found seasonally off Ecuador. The ocean area to the west of the Galápagos is in fact the major swordfish fishery in the tropical Pacific. Catches there are much higher than reported at comparable latitudes of the western Pacific.[79] Sea surface temperature maps show especially narrow temperature isotherms and thus sharp temperature gradients in Ecuadorean waters and ocean areas to the west at latitudes from 5°N-5°S. The temperature isotherms off Ecuador tend to be strong during much of the year, except from January to March (figures 4 and 5).[80] The narrow temperature isotherms and resulting sharp temperature gradients extend well out into the central Pacific. Notably the Japanese longline fishery in the ETP is conducted from 5°N-15°S in the tropical convergence zone. This is the area between the easterly flowing North Equatorial Counter Current (about 5°N) and the westerly flowing Equatorial Current (about 15°S).[81]

Climatic trends: Foreign researchers have demonstrated that swordfish populations and distribution are affected by long-term climatic trends.[82] The authors know, however, of no Latin American research in the ETP assessing the impact of climatic trends.

Photo 9.--Artisanal fishermen operating from dugouts in coastal waters regularly landed sharks, but rarely even a small swordfish. Dennis Weidner

Upwelling: Coastal upwelling is vertical ocean currents which draw up cooler, nutrient-rich water to the surface level of the water column. This process enriches surface waters and supports important stocks of small pelagics. The western coast of South America has the world's strongest upwelling system. Off Ecuador the strength of the upwelling system varies notably from year to year and is much weaker than the stronger Peruvian and Chilean systems to the south. The primary productivity involved, however, does support important small pelagic stocks which can

reach significant levels, even off Ecuador. The populations, or at least distribution, of oceanic predators which feed directly or indirectly on these fodder species may in turn also be affected by fluctuations in the small pelagic populations which can vary greatly from year to year.

Thermocline: The thermocline in a large area of the ETP from southern Mexico to northern Ecuador and the Galápagos is unusually shallow, often less than 50 meters.[83] The thermocline off central and southern Ecuador and to the south and west of the Galápagos is deeper. This may provide more appropriate conditions for swordfish. The authors know of no research assessing the relationship between swordfish and the thermocline, but fishermen have reported a significant relationship. Some fishermen are known to try to set their hooks at the thermocline.[84]

Bottom topography: Bottom topography is known to affect swordfish behavior. The authors know of no assessment of the relationship between bottom topography and swordfish off Ecuador and the other Pacific coast South American countries. Some research, however, has been conducted in other areas.[85]

B. Fishing areas

1) Artisanal

Ecuadorean artisanal fishermen have traditionally conducted operations in inshore coastal waters. The small size of the traditional artisanal craft limited the fishermen to inshore grounds. The artisanal fishermen during recent years have considerably expanded operations off the mainland coast. The fishermen have been forced to move to new offshore grounds as heavy fishing pressure has depleted inshore stocks. The small-scale artisanal fishermen take sharks, but rarely report swordfish (photos 6, 9, 26, and 33). Many fishermen, however, have difficulties reaching offshore grounds in their small boats. (See "Fleet".) In order to economize fuel and at the same time reach more productive fishing grounds, some artisanal fishermen attach their 7.5 m boats ("fibras") to larger semi-commercial (15-28 m) vessels on their way to and from distant offshore fishing grounds (photos 15 and 16). Once the larger vessels reach the fishing grounds, currently as far as 190-320 km offshore, the artisanal fishermen detach their boats and deploy relatively short longlines or begin hook-and-line operations.[86]

Some artisanal longline fishermen have also began to fish around the Galápagos Islands and out of Galápagos ports. Unconfirmed reports indicate that the fishermen have been delivering fish to foreign longliners.[87] The fishermen would like to further expand operations around the Galápagos, but Government approvals have been delayed, in part because of objections of international environmental groups concerned with the preservation of the fragile Galápagos ecosystem.[88] Very serious incidents have occurred between the fishermen and scientists at the Charles Darwin Research Station and in 1997 with park rangers who have been shot at and attacked with bottles and clubs. The Ecuadorean Government is considering limitations on immigration from the mainland and possibly easing land use restrictions. The bill was abandoned when the Bucaram Government fell in 1997. The new Government has established a committee to redraft it.[89]

2) Commercial

Ecuadorean commercial operations are conducted almost entirely in the country's 200-mile TS. Ecuadorean fishermen do not conduct significant distant-water operations. There is some limited effort off neighboring countries, primarily Colombia. The vessels involved are mostly seiners. Given the size of the Ecuadorean 200-mile zone, especially the 200-mile zone around the Galápagos, some operations in Ecuadorean waters are conducted at considerable distance from mainland ports. Operations beyond the Galápagos, for example, have been conducted more than 1,000 km from Manta. Operations are now being conducted out of Galápagos ports. If current trends continue, expanded Ecuadorean operations outside the country's 200-mile zone to the west and southwest of the Galápagos are conceivable.

Tuna seiners: The tuna fishermen operating large purse seiners probably make the longest voyages, but all of their operations are conducted in the ETP, primarily within Ecuadorean waters. A few fishermen, mostly purse-seine operators, however, purchase licenses to fish off neighboring countries. The primary country involved is Colombia which has a major program to license foreign fishing vessels (Colombia, appendices A5b and A6c).[90] Peru has had more restrictive policies toward foreign fishermen. The issue of access for foreign fishermen has proven much more politically charged in Peru and some foreign fishermen have found themselves emersed in complicated political and legal proceedings.[91] The Peruvians have licensed relatively few purse seiners, but have licensed longliners (primarily Japanese) for years.

Longliners: Ecuador's semi-commercial and commercial longliners concentrate their fishing operations between 190-320 km off the mainland coast to the east of the Galápagos. According to a local observer, Ecuadorean semi-commercial and

***Photo 10**--An increasingly modern fleet of small vessels operates on grounds off Manta, Salinas, and other ports. The vessels produce high-quality product suitable for export. A. Paez*

associated longliners fish along the entire length of the country's coast, from Peru to Colombia. According to this observer, swordfish abundance in coastal waters are highest off the northern coast, around Esmeraldas, and farther south, off Salinas.[92] The larger longliners, however, are operating well beyond coastal waters, both in international waters and inside the Ecuadorean 200-mile TS surrounding the Galápagos Islands. This means that some of the longliners are operating more than 1,000 km off the mainland coast.[93] The *Kona Wind*, for example, one of the larger commercial longliners affiliated with an Ecuadorean company, during 1997 was targeting bigeye and swordfish 30-130 km west of the Galápagos Islands (photo 23).[94] The larger longliners targeting bigeye and swordfish concentrate on fishing grounds west of the Galápagos Islands, where yields are better due to current and temperature patterns. (See "Fishing Grounds: Oceanography".) Ecuador's small semi-commercial longliners are, however, often only able to reach these productive fishing grounds seasonally--usually from December to May. The rough seas conditions prevalent from June through November make it dangerous to operate smaller vessels. As the Ecuadorean fleet continues to expand, it is likely that these operations to the west of the Galápagos will increase. This means that the Ecuadoreans are moving into offshore areas already heavily fished by the Japanese (figure 8 and Chile, figure 13). The number of Ecuadorean vessels with such capabilities are still limited, but given the profitability of the fishery and the expanding technical capabilities and experience of Ecuadorean fishermen, such an expansion is likely. The Galápagos provides a ready base for fresh shipments, a profitable option unavailable to the Japanese fishermen. The impact on the Galápagos of expanded commercial and artisanal fishing activity concerns many environmental groups.

IV. Fleet

Ecuadorean fishermen and companies deploy a substantial number of small artisanal and commercial vessels in addition to foreign vessels contracted under association agreements. The authors have received widely varying accounts on the number of vessels involved but some observers believe that there may be as many as 4,000 active vessels, mostly small artisanal craft.

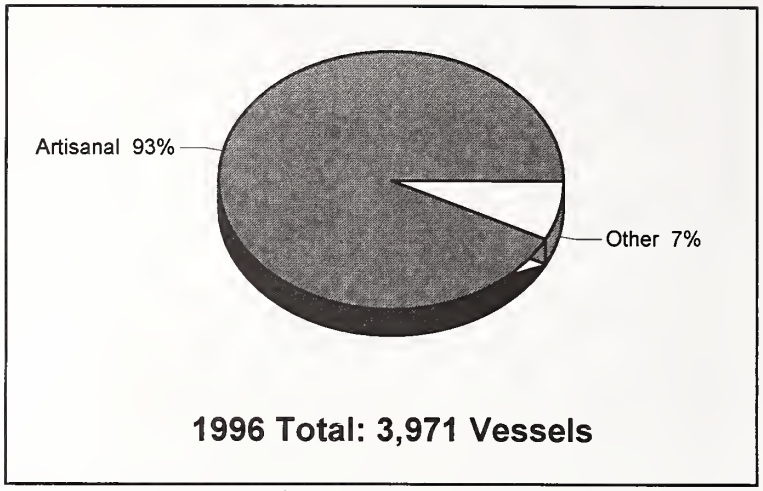

Figure 10.--The great bulk of the Ecuadorean fishing fleet is still composed of artisanal vessels.

A. Domestic

1. Artisanal

The artisanal fleet is very important from a socio-economic point of view since it is the major supplier of fish for domestic consumption and is an important source of employment. The bulk of the Ecuadorean fishing fleet is still composed of small artisanal boats. Local observers estimate that approximately 25,000 artisanal fishermen actively participate in the industry.[95] Accounts vary but there seems to be a total of about 4,000 active fishing vessels in Ecuador, over 90 percent of which are artisanal (appendix A2 and figure 10). Some observers estimate an even larger number of vessels, up to as many as 6,000-8,000 in 1996.[96] The discrepancies between these numbers may be due to the fact that there are many inactive vessels.

Artisanal fishermen have significantly improved their operations in recent years and many now produce export-grade dorado and other hook-and-line and longline-caught fish, including tuna and swordfish. The growth of this fishery is in part due to the expanding artisanal fleet which the Government has promoted in recent years and the relative ease of access to the lucrative U.S. market.[97] The Ecuadorean Government reports that the artisanal fishery is concentrated in Manta, Esmeraldas, Santa Rosa/Salinas, and Puerto Bolívar (appendix A1 and figure 11). The vessels targeting tuna, however, are mostly centered in Manta. These are the vessels that have been reporting a small swordfish by-catch in recent years. Other observers report that Manta is even more important than indicated by official statistics, with as much as 75 percent of the artisanal fleet operating out of the port (appendix A2).[98]

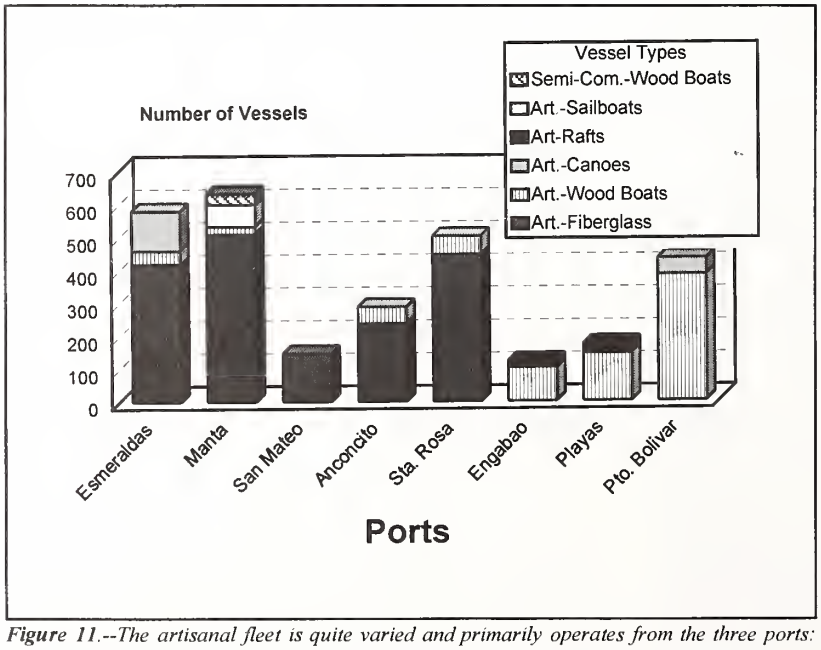

Figure 11.--The artisanal fleet is quite varied and primarily operates from the three ports: Esmeraldas, Manta, and Santa Rosa. There is also some activity at Puerto Bolívar.

Artisanal fishermen operate two principal classes of vessels, both small traditional craft as well as larger more modern boats:

***Photo 11** --One of the authors building a balsa raft in Ecuador during the late 1960s. Julio Cezar Mora*

a. Small craft

Artisanal fishermen have traditionally used small dugout canoes. Some artisanal fishermen still operate these dugouts, but such operations are becoming a much less important sector of the artisanal fleet (figure 11).

Balsa rafts: These craft ("balsas") are made by tying together three or four lightweight balsa logs (photo 11). The balsas can be propelled by paddles or sails. There were about 50 balsas operating from the 8 major Ecuadorean artisanal fishery landing sites during 1995 (appendix A1).[99]

Canoes: These very narrow dug-outs ("canoas or bongos") are carved from a single tree trunk and were traditionally powered by oars (photos 12). Many now have small outboard motors. There were about 170 dugouts operating from the eight major Ecuadorean artisanal fishery landing sites during 1995 (appendix A1).[100]

b. Medium boats

More advanced vessels now dominate the artisanal fleet. The fishermen deploy two basic types of medium-sized vessels which use longlines: fiberglass ("botes fibras") and sail ("botes velas"/"balandras") boats (figure 11 and photos 14-16). Local observers provide widely varying accounts on the numbers of these vessels, ranging from about 1,600 to 4,200. The wide variation may be due to the fact that many of these vessels in 1996 were reportedly inactive. Apparently only a fraction of the fleet was deployed because of declining yields on heavily fished coastal grounds and the limitations of the smaller vessels which are not able to reach new offshore grounds. Other factors are rising operating costs and weak prices (especially for dorado).

Fiberglass: The smaller boats, known as "botes fibras," or "pangas", are 6-8 m fiberglass vessels (photos 13-16).[101] Generally these vessels are equipped with 40-85 horsepower (HP) outboard motors. Ecuadorean observers vary substantially as to the number of these boats, ranging from 1,200-4,000. The INP estimates that there were a total of 1,750 "fibras" based at the eight major landing sites during 1995.[102] Some estimates are much higher. Another INPA report estimated the number of "fibras" at nearly 2,400 in 1994.[103] According to one local observer there are a total of about 4,000 fibras, but only about 500 fibras were active in 1996. Reportedly, the apparent decline in stocks on heavily fished coastal grounds and falling earnings have caused most of these artisanal fishermen to cease operations. The range of these boats limits them to depleted inshore grounds where productivity has declined substantially. These vessels do not have the

***Photo 12** -- Dugouts were the traditional craft used for inshore fisheries in coastal lagoons as well as marine fisheries in the open sea. Dennis Weidner*

range to reach more productive, but distant offshore fishing grounds.[104] Another INP official estimated the number of the smaller artisanal vessels targeting "pescado blanco" (including some oceanic-pelagic and demersal species) with longlines at around 1,200 craft.

Motherships: Several larger commercial vessels operate in association with the small "botes fibras." (See: "Commercial" below.)

Sailboats: Ecuadorean fishermen also deployed about 200 larger (14-15 m) artisanal longliners in 1995. These sailboats known as "balandras" or "botes vela," are equipped with small inboard motors, ranging from 30-190 horsepower. Ecuadorean observers vary somewhat as to the total number of balandras. According to an industry representative, the number of this type of vessel has reportedly increased significantly since 1993 from about 60 to 200.[105] A more conservative estimate of 69 in 1995 is reported by Government officials.[106] The apparent increase in the number of the sailboats within the Ecuadorean fishing fleet has been prompted by sharp fuel price increases (photo 14). The fishermen operating these sailboats save fuel by limiting the use of their motors, usually to the time when actually deploying and retrieving the longlines.[107]

2. Commercial

Ecuadorean observers also vary somewhat as to the number of commercial vessels. Fishermen have deployed shrimp trawlers and small pelagic and tuna seiners for several years. In recent years the fishermen have also begun to deploy small commercial longliners. Ecuadorean observers report that the longline fleet in recent years has significantly expanded. Some report that the fleet in 1996 may total as many as 300 vessels or about 7 percent of the fleet (figure 10). There are two basic types of commercial longliners in Ecuador, smaller wooden vessels and larger steel vessels. Some of the larger wooden vessels serve as motherships for the artisanal vessels.

Wooden hulls: The first type is composed of 15-18 m wooden-hull vessels, known as "barcos maderas" (figure 11 and photos 17-20). Reports on the number of these vessels vary widely. According to an industry representative, the number has significantly increased since 1993 from about 75 to 300 in 1995.[108] The Dirección General de Pesca (DGP) reports that although there may be about 300 such

Photo 13.--Typical artisanal fiberglass "panga" or "fibra", which have largely replaced the traditional dugouts. Otto Schwarz

***Photo 14**--Some boats deploying longlines are equipped with sails as an economy measure. Juan Benicasa*

***Photo 15**--Many "fibras" are towed to fishing grounds by mother ships. This not only conserves fuel but permits the fishermen to reach distant grounds in their small boats. Juan Benicasa*

Photo 16.--A row of "fibras" at the port of Manta, ready for a fishing trip. Ramon Montaño

Photo 17.--A variety of vessels like this small trawler have been converted for longlining. Ramon Montaño

***Photo** 18. --Longliners in the port of Manta. The vessels deploy between 100-200 hooks per set. Boris Buenaventura*

Photo 19.--Typical small wood-hull artisanal vessel. Otto Schwartz

vessels, only a fraction are actively conducting fishing operations. DGP officials report that the high estimate of approximately 300 longliners includes many vessels still under construction.[109] An even more conservative estimate of 35 in 1995 was reported by another Government official.[110] While estimates vary, the fleet does appear to be expanding, primarily due to the growing interest among fishermen in exploiting high-value pelagics. These vessels are mostly powered by inboard 140-455 horsepower (HP) motors.[111] Many of the wood-hull vessels discussed above serve as motherships to the smaller "botes fibras" on their fishing trips. (See "Fleet Operations and Gear".)

Steel hulls: The other category of commercial longliners, or true commercial longliners, is composed of larger 30-40-m steel hull vessels of foreign origin that have been acquired by some Ecuadorean companies (appendices A3a, A3b, and A3d). Again, estimates of the actual number of vessels vary. One fishing company representative estimated that there were about 10 of these larger vessels which were acquired from foreign owners after a period of association.[112] For example, Transmarina, one of the major Ecuadorean fishing companies, owns three 55-m freezer longliners of Japanese origin and shares ownership of a fourth similar vessel. The vessels were previously operated in association with the company. (See "International: Joint venture".) They were subsequently purchased by Transmarina and between 1985-1996 registered under the Ecuadorean flag (appendix A3a).[113] Some of these foreign ventures failed and the vessels abandoned (photo 22).

B. Foreign

Foreign longliners have operated off Ecuador for many years. Most of the vessels are Japanese, but longliners from several other countries have also been active (photo 21). The owners of the foreign longliners operating in Ecuador's 200-mile TS have had to arrange association or leasing contracts with local processing/exporting companies to purchase the catch. A variety of vessel types were involved, but in most years longliners were the primary type of vessel. Some squid jiggers have been active in the 1990s.

1975-79: Initially the foreign vessels were mostly leased, but by 1979 the association contracts were becoming more popular (appendix A5a1). Ecuadorean companies signed leasing and association contracts for 17 vessels in 1977, but the number subsequently

Photo 20.--Another small artisanal vessel landing fresh fish. Otto Schwarz

declined sharply.

1980s: The Ecuadorean Subsecretaría de Recursos Pesqueros (SRP) reports that the number of contracts with foreign vessels during the 1980s has ranged from 11 (1982) to 32 (1988). Virtually all of the contracts involved were association, not leasing contracts. The vessel tonnage involved at the 1988 peak was over 6,000 NRT (appendix A5a1).[114] Some press reports provided somewhat different assessments. Two observers report that there were a total of 12 foreign longliners, from Japan and Korea, operating in Ecuadorean waters under these association contracts during 1982. This foreign longline fleet had a combined capacity of 2,300 NRT, each vessel ranging from 150-240 t and a range of 60-90 days at sea.[115]

***Photo 21**.--Asian longliners have operated extensively off Ecuador, both in international waters and within Ecuadorean waters under association contracts with Ecuadorean companies.*

1990s: The SRP reported 20-24 foreign association contracts during and two leasing contacts during the early 1990s (appendix A5a1 and figure 20). About half of this activity was squid jigging and not longlining.[116] The U.S. Embassy reported that in 1992 that about 24 foreign longliners from Japan, Korea, Panama, and the United States were active (appendix A5c). The authors have received varying accounts as to the countries and number of vessels involved during the 1990s. The Government has not released current details on its licensing program. A local observer reported that the total number of foreign vessels operating within Ecuador's 200-mile TS in 1996 was between 20-25 vessels, including 18 longliners. The countries involved were Japan, Korea, and Canada.[117] (See "International: Joint Venture".) A local business representative estimated the number of foreign longliners during 1996 at 15-20 vessels, all Japanese, except one 30-40-m commercial New Zealand longliner. Transmarina appears to be the principal Ecuadorean company associated with foreign vessel owners during 1996 (appendix A3a). Statistics recently received from the Ecuadorean Government indicate that since 1993 the number and size of the foreign vessels obtaining authorization to operate in Ecuadorean waters has increased, from 20 vessels in 1993 to 30 vessels in 1996 (appendix A5a2). This substantial increase has been accompanied by a gradual increase in the sizes of the vessels deployed, from 455 GRT in 1993 to 628 GRT in 1997.[118]

***Photo 22**.--Efforts by Ecuadorean companies to acquire and operate large commercial longliners have proven unsuccessful. These Korean longliners were abandoned in the port of Manta. R. Montaño*

The foreign fishermen involved are primarily Japanese, but association/leasing contracts have been signed with fishermen from several other countries:

Canada: According to Ecuadorean Government officials, there were about 4-5 Canadian longliners operating under an association contract

with a local company in 1996.[119] Although not confirmed by the company, one report suggests these longliners were associated with LUBAR. (See "Companies".)

Japan: The Japanese longliners, like the Ecuadorean commercial longline fleet, target bigeye tuna. These longliners are steel hulled vessels that are approximately 30-40 m in length.[120] The vessels generally range in size from 280-400 GRT (appendix A5c).[121] The precise number of vessels, however, is unavailable. Several Japanese longliners were fishing in association with Ecuadorean companies during the early 1980s.[122] A Government official reported that since 1985, the number of foreign longliners operating in association with Ecuadorean companies has been fairly stable at about 15-20 vessels.[123] There were between 10-20 Japanese longliners operating in Ecuadorean waters under such association contracts in 1989.[124] The U.S. Embassy, for example, reported 18 Japanese longliners in 1992 (appendix A5c). The authors do not know precisely how many Japanese vessels were operating in 1996 due to discrepancies in accounts from local sources. Several different Ecuadorean companies work in association with the Japanese. For example, Transmarina is associated with six 55-m Japanese freezer longliners (appendix A3a).[125] According to one Ecuadorean observer, there were about 10 Japanese commercial longliners fishing within Ecuador's 200-mile TS in early 1996.[126] Another local observer reported a substantially larger number of vessels during 1996, indicating that about 21 Japanese longliners were active.[127] The authors believe, based on these reports, that the number of Japanese commercial longliners in recent years has ranged between 15-25 vessels.

Korea: The Korean vessels that have worked off Ecuador are quite similar to the smaller Japanese longliners (appendix A3d and A5c). Many were in fact built in Japan. There have been some Korean longliners operating in association with Ecuadorean companies during the 1980s.[128] Two Korean longliners were active in 1992 (appendix A5c). According to a Government official there were about five 40-50-m Korean longliners operating in Ecuador under association contracts during 1996.[129]

Other: The characteristics of the relatively small number of longliners deployed by the other countries vary substantially. Longliners as small as 57 NRT have been reported (appendix A5c). A New Zealand longliner was working with PESYMAR during 1996-97 (photo 23).

***Photo 23**.--A New Zealand company deployed the 28-m longliner Kona Wind in waters west of the Galápagos through a 1996 joint venture and is considering operations off Colombia. Terry Smith*

C. Flag-of-convenience vessels

Ecuadorean Government officials report that the country does not make flag-of-convenience registrations. Officials also report that no flag-of-convenience longliners are authorized to operate in Ecuadorean waters.[130] Two Central American countries (Honduras and Panama) authorize large numbers of flag-of-convenience registrations, often of Taiwan-owned vessels.[131] The authors have received a few scattered reports of flag-of-convenience longliners operating in Ecuador. According to one local observer there were about two or three large longliners based in Manta registered under Honduran and other flag-of-convenience flags.[132] The authors are unsure how to reconcile these conflicting reports. While large numbers of vessels are not involved, a few flag-of-convenience vessels have been observed in Ecuadorean ports. Possibly they are vessels in the process of being sold to Ecuadorean companies and thus not considered as flag-of-convenience vessels by the local authorities.

V. Shipyards

Ecuadorean shipwrights and shipyards build most of the small vessels deployed by domestic fishermen, especially the artisanal fishermen. Ecuadorean yards, however, build very few vessels in excess of 100 GRT, although one yard is known to have built a 318-GRT seiner. Little information is available on specific Ecuadorean yards, but construction is believed to be primarily shrimp trawlers and small vessels for the hook-and-line fishery. The authors know of no domestically constructed commercial longliners.

A number of small yards or shipwrights construct the semi-commercial wooden longliners. (See "Fleet.") Many of these small yards are based in Manta, although there are also a few located in other coastal towns such as Esmeraldas and Jaramijo. Astillero Panchaná and Astillero El Rápido are among such small shipyards located in Manta. Astilleros Panchaná and El Rápido, like many small yards, specialize in the construction of wooden longliners ranging from 20-28-m in length.[133] There are five artisanal shipyards in Guayaquil which specialize in the construction and maintenance of wooden longliners.[134] The smaller artisanal boats (fibras) are built by small companies specializing in fiberglass construction, such as Italfibra.[135]

There are two principal shipyards in Ecuador (Astinave and Botadora) which service commercial vessels. Both of these yards are located in the Guayaquil area. These yards specialize in shrimp trawlers and small seiners as well as a range of other vessel types. Astinave, for example, also builds oil tankers, cargo ships, tugboats, speed boats, and multi-purpose fiberglass vessels.[136] Neither build commercial longliners. According to a local observer, these shipyards provide only limited maintenance services to the foreign commercial longliners operating in Ecuador, as most of the foreign fleet is usually serviced in their national shipyards.[137] According to company officials, Astinave provides general maintenance services to commercial longliners at their docks.[138]

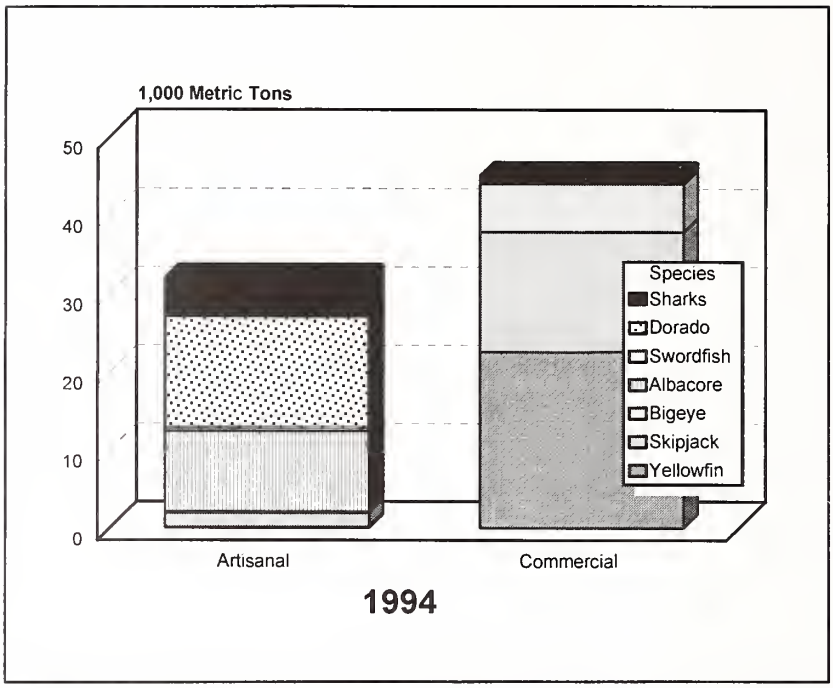

Figure 12--The species mix of the artisanal and commercial fleet is quite varied, but neither groups have until 1996 reported significant swordfish catches.

VI. Fleet Operations and Gear

Ecuadorean finfish fishermen divide their fishing operations into three different categories, depending upon the target species. Oceanic pelagics are an important portion of the whitefish and tuna catch and both artisanal and commercial fishermen are active, however, swordfish has been of minimal importance (appendices B2c1-2 and figures 12 and 13):

Whitefish: This category, known locally as "pescado blanco" is composed of pelagic and demersal species, such as corvina, dorado, grouper, marlin, sailfish, shark, snapper, albacore, swordfish, and wahoo, that are caught primarily with longlines (surface or bottom) and gillnets. [139] Much of the swordfish catch has been taken by these artisanal fishermen (appendix B2b and figure 18).

Tuna: The second category is composed of all species of tuna, which are caught with longlines or purse seines. Almost all of Ecuador's catch of high quality tuna, swordfish, and other oceanic pelagics is taken by longlines. Most of the bigeye and yellowfin tuna catch is landed by the commercial fishermen (appendix B2c1-2 and figures 12 and 13). Ecuador has an important fleet of small purse seiners which target tuna, but the catch is used for local canning or frozen product to supply foreign canneries (photo 28).

Small pelagic: This category is composed of small coastal pelagic species, such as sardines and thread herring, which are primarily caught with purse seines.[140] This fishery has fallen significantly in recent years because of declining stocks.

A. Artisanal

1) Small-sized boats

The authors have limited information on the operations of small-scale artisanal fishermen in Ecuador. Until recently most of these fishermen earned very little and conducted essentially subsistence fisheries (photo 25). This has changed significantly in recent years as the expanding shrimp culture industry has created well paying jobs in isolated coastal areas. In addition the development of export markets has significantly increased the income of fishermen who have

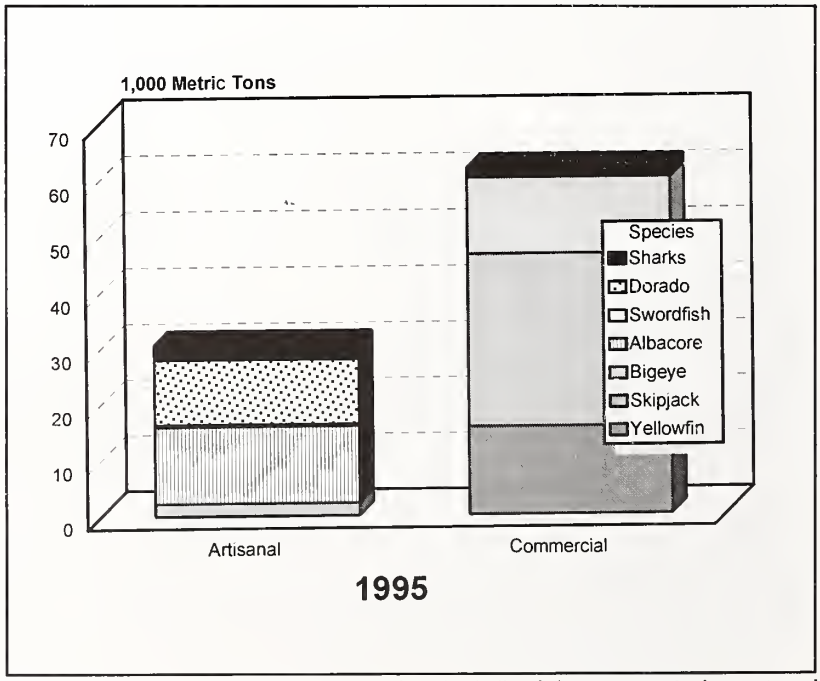

Figure 13--Ecuador's commercial fleet takes the bulk of the tuna catch, but artisanal fishermen land most of the albacore.

***Photo 24**.--Dorado was the principal "whitefish" taken by artisanal fishermen, but catches have fallen in recent years. Dennis Weidner*

***Photo 25**.--Through the 1970s, living standards for fishermen in isolated coastal communities were very low, as the fishermen had virtually no access to mainland markets. Tom Healey*

***Photo 26**--Some artisanal fishermen targeted sharks on the open ocean from small dugout canoes. Some of the sharks were nearly as large as the dugouts. Dennis Weidner*

improved their fishing and handling techniques to meet the demanding export standards of foreign countries.

Much of the artisanal fishery was conducted in inshore waters such as coastal lagoons (photo 12). Many intrepid fishermen, however, also ventured on to the open ocean. One 1950s report indicated that the artisanal fishermen fishing off the coast were taking large black marlins with handlines from dugout canoes.[141] Many artisanal fishermen in the 1970s and early 1980's were still using primitive handlines from rafts, canoes, and other small craft. The fishermen have since significantly modernized their operations.

Balsa rafts: Ecuadorean fishermen use balsa rafts for fishing trips of no more than 8 hours. The primary fishing gear utilized by the fishermen in the "balsas" is hook and line. Among the most common species of fish caught by these fishermen are catfish, corvina, and a range of other low-value species.[142]

Canoes: Fishermen utilizing canoes can generally conduct fishing operations for up to 8 hours. The primary fishing gear used by the fishermen is also hook and line. Similar to the rafts, the most common species of fish landed are catfish, corvina, and a range of other low-value species.[143] Often the fishermen go out at night and return in the early morning. Some canoes are used as reefers to land fish taken by larger boats. The authors have observed some fishermen landing sharks that were nearly as long as their dugout canoe (photos 26, 33, and 42). The fishermen also take sea turtles, but no information is available on the numbers involved (photo 43).

2) Medium-sized boats

Ecuadorean artisanal fishermen using medium-sized boats are reportedly deploying longlines and drift gillnets to take oceanic pelagics and other species on inshore grounds.[144] The artisanal fishermen conduct a variety of operations, however they have not targeted swordfish. The primary target species are bigeye tuna and dorado, which are generally caught with hand lines and longlines, respectively.

Fiberglass: The smaller longliners, "fibras", are approximately 7.5 m in length and carry three fishermen. They can only remain offshore for short periods--generally 1 or 2 days when operating individually. The artisanal vessels are sometimes equipped with 50-100 hook surface longlines measuring up to 2 kilometers.[145] Somewhat longer longlines of up to 4.5 km are reported by another industry representative.[146] Most of the fishermen operating these artisanal vessels fish with hand lines. Dorado is seasonally an important target species. Other vessels are equipped with bottom longlines "espinel de fondo" to target demersal fish such as corvina, grouper, and snapper. Some are also equipped with surface drift gillnets to target billfish and tuna.[147] "Fibras," without the assistance of motherships, can generally operate only about 50 km offshore.[148] According to a local observer, the fishermen target mostly bigeye. The average size of each bigeye tuna caught by these vessels range from 45-110 kilograms.

Wooden hulls (Motherships): Artisanal fishermen have reported sharp increases in fuel prices and declining catches on inshore grounds. As a result, many rely on commercial motherships to pull groups of 5-10 "fibras" to more productive offshore grounds (photos 15 and 16). Not only does this permit the fishermen to reach the more productive distant grounds, it also reduces their fuel expenses. The fibras working with motherships can remain offshore for longer periods, further increasing their fishing and

***Photo 27.**--Artisanal fishermen unloading dorado on the beach at Manta Otto Schwarz*

fuel efficiency.[149] In addition, the motherships supply the artisanal fishermen with bait, fuel, ice, food, shelter, and water, as well as store the catch in ice holds. Access to ice holds is critical in meeting the quality standards of export markets. Working with the motherships allows the artisanal fishermen to remain offshore for periods of up to 10 days and still deliver high-quality fish. Upon arrival on the fishing grounds, the smaller vessels detach from the mothership and begin fishing with longlines, normally between 2.0-4.5 km long, or with hook-and-lines. The catch of the smaller vessels is transshipped to the mothership, where it is headed and gutted, and stored in the hold with an ice-water slurry.[150] According to an industry representative, the fishermen in the small "fibras" take most of their bigeye with hook-and-lines, while the dorado and shark are caught mainly with small longlines.[151] The motherships, which range from 12-40 m in length, also conduct fishing operations after towing the smaller vessels to the fishing grounds. An increasing number of these vessels are targeting grounds to the west of the Galápagos (photo 23). Some of the catch is landed and air-freighted through Santa Cruz in the Galápagos Islands.[152] According to a local observer, the fishermen operating the semi-commercial motherships which target bigeye with handlines and longlines east of the Galápagos Islands catch fish ranging from 45-110 kilograms. The mothership's catch is composed of tuna (60 percent), sharks (20 percent), swordfish (5 percent), various species such as marlin, grouper, wahoo, and dorado (15 percent), a similar ratio to that of the artisanal fibras.[153] Generally, the motherships conduct fishing trips of 7-10 days.[154] According to an industry representative, the motherships deploy longlines of up to 500 hooks (about 15 km long).[155] This type of vessel (mothership) is described variously by some Ecuadorean observers as artisanal and as semi-commercial by others.

Sailboats: The other type of longliner is composed of about 200 14-15 m sailboats, known as "balandras" which are also equipped with outboard motors (photo 14). The balandras can generally remain offshore for periods between 6-8 days.[156] These vessels usually deploy 150-hook longlines of up to 4 km in length.[157] The fishermen mainly target bigeye tuna, although dorado, shark, blue and striped marlin, and swordfish are also taken.[158]

Conflicts exist between the artisanal and commercial fishermen, as is common in many Latin American countries. The commercial fishermen are especially critical of expanding artisanal driftnet operations. The authors believe that much of the driftnet effort is coastal and the catch of tunas, swordfish, and other oceanic pelagics is therefore limited. The commercial fishermen seem most concerned about the shrimp catch as the fishermen are using fairly small mesh driftnets, 10-15 centimeters (cm). One report suggests the nets range from 1.5-2.0 km in length.[159] Details on the deployment and catch, however, are unavailable.

B. Commercial

The two major types of commercial longliners fishing off Ecuador conduct significantly different operations. Most of these vessels primarily target tuna and report only limited swordfish by-catches (appendix B3b). One report suggests, however, that interest in swordfish is growing and five vessels during 1997 were targeting swordfish. The authors have received widely varying reports on the number of vessels involved. (See "Fleet".)

Photo 28 --Landing bigeye tuna taken in fisheries east of the Galápagos by the joint venture Prime North Ecuador. Terry Smith

Medium vessels: The first type is 15-28 m, mostly wooden-hull vessels equipped with 6-km longlines deploying up to 300 hooks. It is this type of vessel which serves as a mothership to the smaller artisanal longliners. (See "Artisanal" above.) These vessels can remain on offshore fishing grounds for 6-15 days. They generally conduct fishing operations 190-320 km from the coast, although some travel as far as the Galápagos, located around 1,000 km off the mainland, and a few are now operating beyond the Galápagos. The longliners targeting bigeye usually set the hooks between 90-130 m deep. They generally start deploying the longlines in the afternoon, around 5:00 pm, and retrieve them the following morning, around 7:00 am. This general pattern varies depending on the captain's view on when the fish are feeding.[160]

Large vessels: The other type of commercial longliner is a larger 30-40 m, mostly steel-hull freezer vessel built in Asian shipyards. There are about five of these vessels currently active (appendix A3b). They deploy longlines with up to 1,000 hooks. According to an Ecuadorean Government official, these vessels land approximately 100-150 t of fish (mostly bigeye) per trip, which is normally about 30-40 days.[161] Most of these vessels are foreign longliners associated with Ecuadorean companies. For example, the *Kona Wind*, a 28-m steel longliner is owned by a New Zealand company associated with a local export company (photo 23). The *Kona Wind*, which is crewed by 10 people, generally deploys 800 hooks, although it can deploy up to 1,200 hooks by adding more segments to the motherline. The longline, which is American-style, measures 37 kilometers.[162] The commercial longliners targeting swordfish set the hooks at approximately 90-130 m, depending on the water temperature. The longliners targeting bigeye set the hooks at approximately the same depth. The large commercial longliners targeting bigeye and swordfish usually deploy the longlines around 5:00 pm and retrieve them at around 7:00 am.[163] These larger vessels, like the *Kona Wind* are the primary vessels that have begun to fish on the new offshore grounds to the west of the Galápagos. The *Kona Wind*, as a result, reports substantial swordfish catches (figure 14).

C. Recreational

The first known recreational fishery off Ecuador occurred around 1940 when a U.S. citizen living in Ecuador reported taking a black marlin. He also reported good catches of roosterfish and wahoo. Reportedly, an Ecuadorean friend purchased a 21-m yacht which they used for sport fishing. Their success attracted other fishermen. Salinas became the center of the small recreational fishing activities which developed during the 1940s and early 1950s. Salinas is a resort for the large metropolitan area of Guayaquil and thus an ideal site for a recreational fishery. The waters off Cape San Lorenzo, to the north of Salinas, were the preferred grounds. Fishermen in the 1950s reported seeing many marlin moving north as well as sailfish. In contrast to northern Peru, recreational fishermen active during this period out of Ecuadorean ports did not report any significant sightings of swordfish.[164] No significant development of the potential for recreational fishing, however, ensued from these activities during 1940-50s.[165]

The sport fishermen have reported diminishing results in recent years.[166] A local observer reports that there are a total of approximately 50 relatively large sport fishing vessels in Ecuador which are regularly deployed in the sport fishery for blue marlin, sailfish, striped marlin, swordfish, and tunas. These mostly fiberglass vessels range from about 12-15 meters. Of the 50 vessel total, most are located at Salinas (25) and Guayaquil (20). A few (5) are also located at Manta. In addition to this fleet, there is another fleet composed of about 50 smaller (8.5 m) fiberglass vessels that have been equipped for sport fishing. According to a local observer, most of these vessels are located in Salinas (approximately 30), while the remaining are based off Manta (20 vessels). This fleet targets the same species.[167]

Ecuador also has a small sport fishery based in the Galápagos. It is centered in Wreck Bay, San Cristóbal, where six boats are based: *Maria Beatriz, Misamiras, Obsesión, Sea Baby, Texan Girl*, and *Thalassa*. One vessel is operated by a processing plant owner. This Galápagos sport fishery targets billfish among other species. The sport fishermen are reported to be conducting a "tag and release" fishery but locals indicate that marlin and other billfish are appearing in the Baquerizo Moreno market for the first time.[168]

The Ecuadorean Parque Nacional Galápagos (PNG) in 1994 asked the Estación Charles Darwin (ECD) to evaluate the feasibility of a sport fishery within the Reserva de Recursos Marinos de Galápagos (RRMG) making party boats available to tourists.[169] The ECD informed the PNG that it did not recommend a sport fishery within the RRMG. The ECD recommendation was based on the absence of adequate data on marine resources to make informed management decisions. They stressed that careful management is particularly important in a fragile ecosystem like the Galápagos with so many unique species. The ECD was particularly concerned about the potential impact of the expanded infrastructure needed to support a recreational fishing industry.[170] The PNG formulated a new sport fishing initiative in the Galápagos as an alternative for artisanal fishermen who some conservationists believe are over-exploiting the Galápagos sea cucumber and other resources. The proposal has been studied by the Ecuadorean Congress.[171] One local observer reported four boats fishing billfish during May 1995.[172] This may be part of CONSEPAC's fishing operations. (See: "Companies".) The whole issue of commercial and recreational fishing off the Galápagos has become highly politicized. Hard pressed Ecuadorean fishermen have migrated from the mainland and strongly object to government actions limiting their activities. Groups of these fishermen have occasionally surrounded the ECD and closed the Santa Cruz (Galápagos) airport. Violent incidents have been reported.[173] The Government sent 150 Marines in 1996 to control the situation. Other residents in the Galápagos understand the need to protect the fragile local resources and have formed an association, the Comité de Paz y Buena Voluntad.[174]

VII. Catch

Ecuador developed a modest, but profitable domestic longline fishery during the 1980s in operations between the Galápagos and the mainland. The fishermen reported substantial catches of tunas (primarily bigeye) and dorado. Swordfish catches, however, have been limited and incidental to the directed fisheries. The Ecuadorean effort is significant. Accounts vary, but as many as 4,000 small artisanal longliners and 300 semi-commercial longliners are reportedly active (figure 10). (See "Fleet".) Despite this considerable fleet, swordfish landings have been minor. Informal discussions with some of the principal fishing companies suggest that swordfish represented only about 5 percent of the domestic longline catch.[175] (See: "Companies.") Government officials reported incidental swordfish catches comprised only 1.5 and 2.7 percent of the commercial longline catch in 1993 and 1994, respectively.[176]

Ecuadorean fishermen beginning in 1996 initiated operations to the west of the Galápagos. The fishermen on these new grounds are reporting much higher swordfish catches. One company in 1996 deployed Ecuador's first large commercial longliner (*Don Casi II*) to conduct directed swordfish operations. The vessel reportedly achieved some success and, as a result, six longliners are now targeting the species (appendix A3b). Some of these vessels are tuna longliners which were shifted to swordfish operations. Others are new vessels that have been added to the fleet. These new vessels are semi-commercial longliners which target swordfish, mainly on fishing grounds west of the Galápagos Islands (appendix A3b). The *Kona Wind*, a New Zealand-flagged vessel fishing in association with a local company was, for example conducting fishing operations for swordfish west of the Galápagos Islands during 1997. The vessel's total catch was composed of shark (approximately 40 percent), swordfish (25 percent), tuna--mostly bigeye (15 percent), and various species including marlin, dorado, wahoo, among others (20 percent) (figure 14).[177]

Only limited time-line data are available on Ecuadorean swordfish catches, making patterns in Ecuadorean domestic swordfish catches difficult to assess. Other problems exist besides the paucity of data. Serious unexplained discrepancies exist between available sources. Even INP data sets are inconsistent, presumably because the species has been only of minor importance (appendices B2b1-2). Confusion may occur because Ecuadorean officials often report the catch of the associated foreign vessels as part of their domestic catch (appendix B2b2). Even if accurate catch data was available, as the species was not directly targeted, fluctuations might reflect changing fishing strategies for the target species rather than actual swordfish abundance.

Historical trends: Virtually no historical domestic catch data exists. The only available time-line estimates can be calculated by analyzing foreign import data.

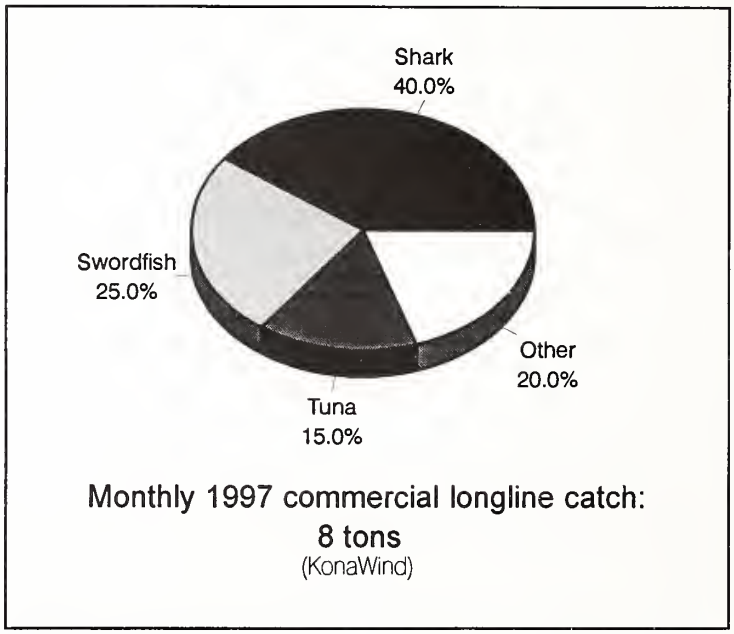

***Figure 14**--Ecuadorean and associated longliners are reporting increased swordfish catches along with substantial shark and tuna catches.*

Catch data: Ecuadorean officials have given little attention to swordfish as the species has been of only marginal importance to the country's fishermen. It is likely that at least some swordfish was taken before 1990, but none has been reported by the Ecuadorean Government (appendix B2a).

Import data: The authors have attempted to estimate historic trends by calculating the live-weight equivalents of U.S. import data (appendix D1a and figure 15) which is probably a fair reflection of catch trends.[178] The relatively long time series available on imports provide some possible insight into historical trends. Some shipments were reported during the 1970s, but significant swordfish catches were minor or negligible until the mid-1980s when the

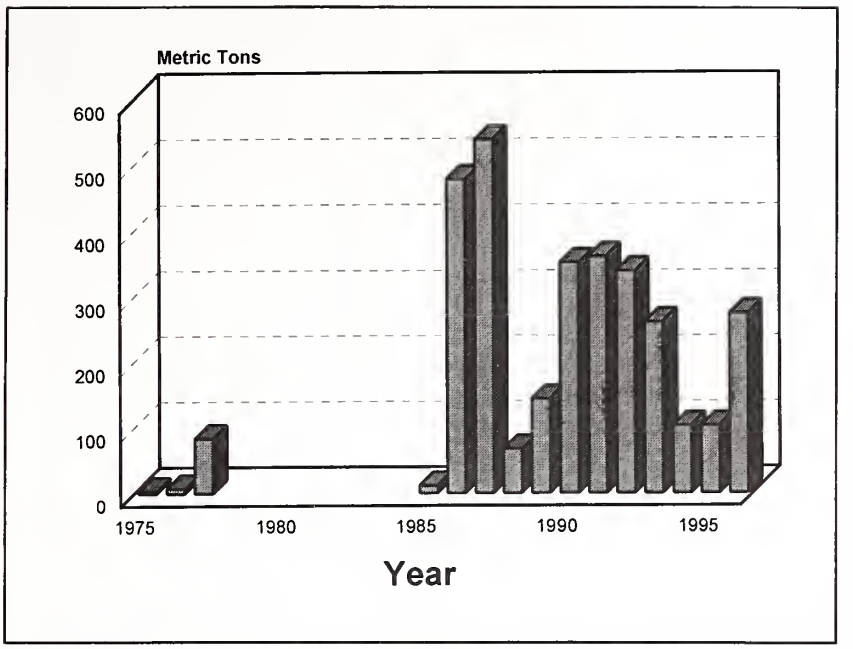

Figure 15.--U.S. import data provides a rough indication of Ecuadorean swordfish catch trends which can be used to assess years in which catch data is unavailable.

tuna/dorado longline fishery began. Imports were particularly significant during 1986-87 suggesting catches of about 500 t (appendix B2a).

Recent developments: The Ecuadorean Government began reporting a domestic swordfish catch in 1990. Trends during the 1990s are difficult to assess because the authors have received a variety of often conflicting reports--especially for the period since 1993. The INP reported very large swordfish catches during 1994 -95, United States and other foreign import data should reflect catch trends as such a large part of the swordfish catch is exported. The foreign import data (appendix B2d and figure 17), however, does not confirm the higher level of catches noted by the INP during 1994-95 (appendices B2a, B2b1-2, and B2c1-2 and figure 16). U.S. import data does show increases in 1996, but only accounts for about half of the fish reported by the INP (B2a). The authors note, however, that U.S. import data does suggest substantially higher catches during early 1997 (appendix D2h).

Catch data: The INP estimates of domestic catches during the early 1990s ranged from 200-360 t (appendix B2a and figure 16).[179] Ecuadorean data reported to FAO confirm that catches in the early 1990s were about 350 t, but declined sharply in 1993 (appendix B2a). The authors do not have INP time-line data, but the INP has reported catches of about 500 t during 1994-95.

Import data: U.S. import data (appendix B2a and figure 15) provide a longer time-line than the available Ecuadorean catch data. As much of the catch is exported to the United States, the authors believe that U.S. imports are a reasonably good reflection of actual catches. U.S. import data appears to have reflected catches of at least 350 t in the early 1990s (1990-92), then falling to 260 t (1993), and about 100 t (1994-95). The U.S. data then shows a significant increase to about 275 t in 1996. Preliminary data for 1997 suggests major catch increases in early 1997 (appendix D2h). Computing the live-weight equivalents of other foreign imports (the European Union and Japan) would suggest even higher Ecuadorean catches. European Union and Japanese imports (appendix B2d and figure 17), however, are almost all frozen and thus are probably fish taken by associated foreign longliners working with Ecuadorean companies (appendices A5a1-2 and B2b2 and figures 18 and 20) and not fish caught by domestic fishermen.

Discrepancies: There are serious discrepancies between the available catch (both FAO and INP) as well as data provided by different INP researchers (appendices B2a and B2b1-2). The foreign import data suggests catches exceeding 500 t were first reported in 1986, although this level of effort is not confirmed by Ecuadorean catch data until 1990. Recent swordfish catch data is even more confusing. The Ecuadorean Government reported a major decline to FAO in 1993, indicating that the catch was only about 35 t (appendix B2a). Since 1993 the Government has reported negligible catches to FAO. The INP, a unit of the Ecuadorean Government, however, reports 1994-95 catches of 450-525 tons. U.S. import data in some years confirms available catch data (1990-92) (appendix B2a). Since 1992, however, there have been major discrepancies between Ecuadorean catch and other foreign trade data. This suggests a major statistical problem because swordfish is primarily an export commodity in Ecuador and catch trends should presumably be reflected in foreign trade trends.

Available details on annual catch patterns are as follows:

1970s: The Ecuadorean Government in 1974 enacted its General Fisheries Law to manage and promote the country's fishing industry. One important provision allowed processing/exporting companies to lease foreign fishing vessels or sign association agreements with foreign vessel owners. Several Ecuadorean companies took advantage of the opportunity. Initially the leasing arrangements were the most common, but by the end of the decade the Ecuadorean companies concluded that the association contracts were the most beneficial (appendix A5a1). Many of these association contracts with foreign, often, Japanese companies, involved tuna longliners. As a result of these agreements, Ecuadorean companies began exporting small quantities of swordfish for the first time during the mid-1970s. The United States began importing significant amounts of swordfish from Ecuador in 1977. U.S. data suggest that 1977 imports totaled about 67 tons. Based on this amount, the authors estimate the 1977 swordfish catch (live weight) at about 85 t (appendix B2a and figure 15). The source of these shipments could not be determined. However, it is likely that they were swordfish caught by the foreign vessels associated with Ecuadorean companies. Notably leasing contracts with foreign companies peaked at 13 in 1977 and subsequently declined. Such shipments were discontinued and no swordfish exports were noted in 1978 and 1979. This corresponds with a rapid decline in the number of leasing contracts with foreign companies (appendix A5a1 and figure 20).

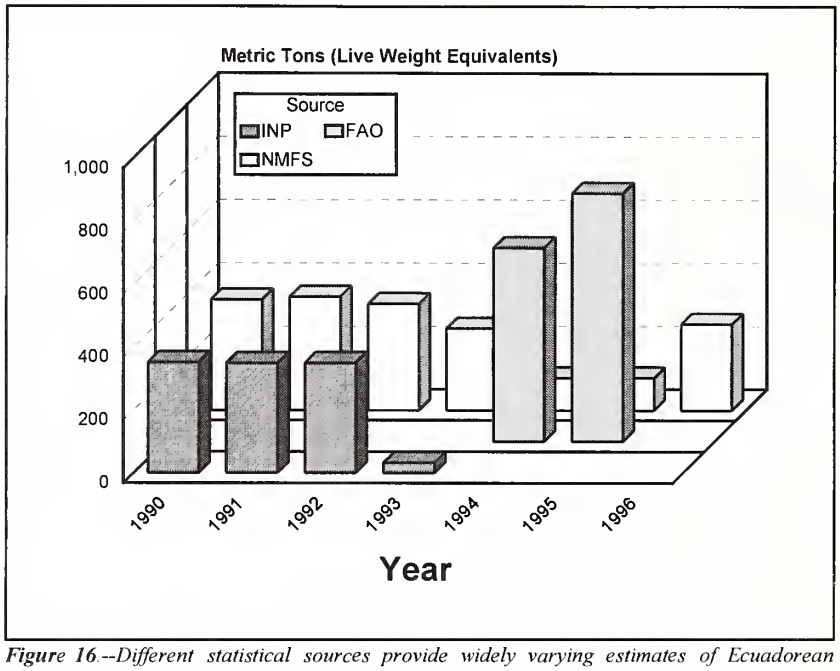

Figure 16.--Different statistical sources provide widely varying estimates of Ecuadorean swordfish catch trends.

Early 1980s: Swordfish catches were apparently negligible during the early 1980s. While actual catch data is unavailable, U.S. import data shows that Ecuador was not exporting swordfish to the United States during the early 1980s (appendix B2a and figure 15). This suggests that the catch was negligible because it is likely that this species would have been marketed primarily in export markets if it was being harvested in any quantity. Ecuadorean companies formed increasing numbers of association contracts with foreign vessel owners during 1980-81. The number of contracts ranged from 11-17 during 1980-81 and reached 17 in 1983 (appendix A5a1 and figure 20). This is roughly confirmed by available journalistic reports.[180] These vessels, however, targeted bigeye tuna and swordfish catches seem to have been minimal.

1984-85: While no catch data is available, U.S. import data suggests that Ecuadorean domestic fishermen began landing swordfish in 1985. This corresponds to the period when Ecuadorean fishermen were beginning to develop a more modern artisanal longline fishery. The authors believe that because the U.S. imports were fresh rather than frozen product, they were probably being landed by the small vessels which artisanal fishermen began to deploy in the mid-1980s that were heavily targeting dorado. (See "Vessels" and "Fleet Operations and Gear".) The artisanal fishermen began catching substantial quantities of dorado.[181] U.S. import data suggests that the Ecuadorean swordfish catch probably totaled about 12 t in 1985 (appendix B2a and figure 15). CONSEMAR, one of the principal Ecuadorean companies exporting high-quality fresh and frozen finfish, began operating in 1984 and played an important role in helping artisanal fishermen improve the quality of their landings. TRANSMARINA, another important Ecuadorean company which played an important role in developing fisheries capable of delivering high-quality fresh and frozen product meeting export standards, acquired its first longliner in 1985 (appendix A3c).[182] The number of

associated foreign vessels increased to 22 in 1984 (appendix A5a1).

1986: Ecuador reported no significant swordfish catch in 1986. Available foreign import data, however, shows that beginning in 1986, very significant quantities of swordfish were shipped from Ecuador. U.S. imports totaled nearly 500 t (live-weight equivalent) in 1986 (appendix B2a and figure 15). As this was almost all fresh product, the authors believe that it was mostly the catch of domestic artisanal fishermen. No details are available, however, explaining such a sharp catch increase. PESYMAR, another company handling high-quality fresh product, opened in 1986 (appendix A3c). Japan also reported limited frozen imports, but this may have been product from foreign longliners associated with Ecuadorean companies (appendix B2d).[183] The Government, at the time, was promoting association agreements in order to help develop the country's fishing industry.[184] The number of association contracts was relatively stable at 20 vessels during 1986 (appendix A5a1).

1987: Ecuador continued to report no swordfish catch, but foreign import data continued to suggest that the fishermen landed very significant quantities. U.S. imports from Ecuador peaked at over 535 t in 1987 (live-weight equivalent) (appendix B2a and figure 15). Again, as this was almost all fresh product, the authors believe that the shipments were mostly the catch of domestic artisanal fishermen. Another small company (MARDEX) was opened in 1987 to process the catch, but did not acquire its own vessels until 1990 (appendix A3c). Japan also reported increasing amounts of frozen imports of swordfish from Ecuador, totaling nearly 100 t in 1987. These imports, as they were frozen, most likely were product landed by the associated foreign longliners and not fish harvested by the domestic fishermen (appendix B2d). Notably the number of association contracts increased to 25 vessels during 1987 (appendix A5a1).

1988: The Ecuadorean Government did not report swordfish catches in 1988. Foreign import data, however, suggests that Ecuadorean swordfish catches significantly decreased. U.S. imports, which the authors believe reflect domestic landings, declined to only 68 tons--a decline of over 85 percent from 1987 levels (appendix B2a and figures 15 and 17). The authors have little information explaining such a precipitous decline in the domestic fishery. Although the INP noted no swordfish catch in its official statistics, Government officials acknowledged that some swordfish was being landed and confirmed that catches declined in 1988. One official reported that the catch declined primarily due to a decrease in swordfish abundance. DGP officials charge that large numbers of foreign vessels were deploying drift gillnets outside the country's 200-mile territorial sea.[185] The authors have no information confirming this allegation. A variety of other explanations are plausible such as climatic conditions affecting availability. Associated foreign vessels also seem to have experienced a catch decline. Japan reported declining imports of swordfish from Ecuador and shipments fell to only 50 tons. The authors believe that these shipments were product landed by the associated foreign vessels. Inexplicably the actual number of association contracts increased to a record high 32 vessels (appendix A5a1).

1989: The Ecuadorean Government continued to report no swordfish catches to FAO as late as 1989. Based on U.S. import data, however, swordfish catches increased slightly over 1988 levels, but still were well below the peak years of 1986-87. U.S. swordfish imports from Ecuador approached 150 t (live weight) (appendix B2a and figures 15 and 17) which presumably means that the Ecuadorean fishermen had to catch at least this amount. Japan also reported increasing swordfish imports from Ecuador, totaling over 60 t (liveweight) (appendix B2d and figure 17). This frozen product, however, may have come primarily from the associated foreign

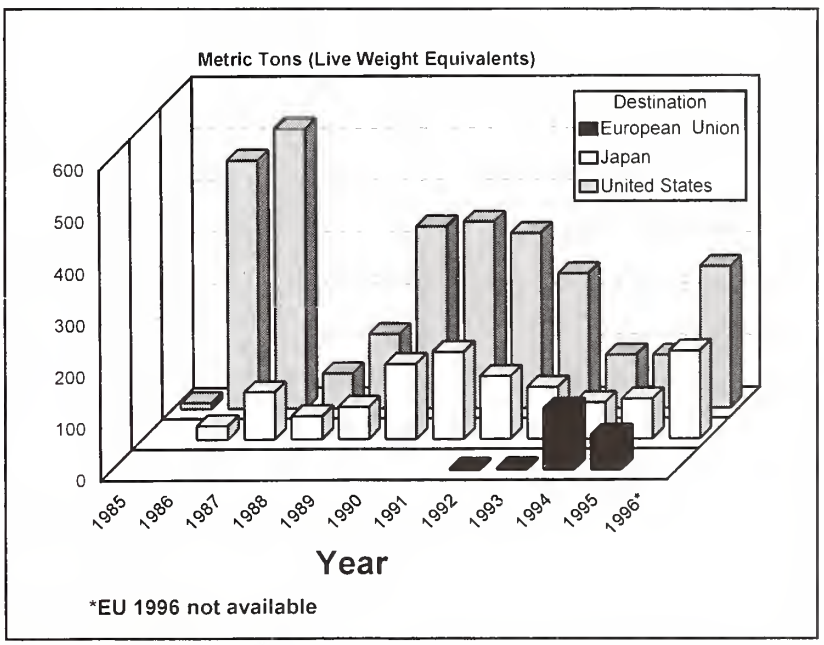

Figure 17.--Combining foreign import data provides a possible estimate of Ecuadorean catches, although Japanese and European import data may include some swordfish caught by non-Ecuadorean fishermen.

vessels. The INP reports that the associated vessels landed 22 t of swordfish in 1989, the first year in which reports were required.[186] The number of associated contracts fell in 1989 to more normal levels, about 24 vessels (appendix A5a1 and figure 20).

1990: The Ecuadorean Government reported a swordfish catch to FAO for the first time in 1990 of 350 t (appendix B2a). Available U.S. import data also show a substantial swordfish catch increase. U.S. swordfish imports from Ecuador increased to slightly over 350 t (live weight) (appendix B2d), confirming the Government catch data. The U.S. import data suggests a significant catch increase in 1990, more than double the 1989 catch estimated from imports (appendix B2a and figures 15 and 16). The authors believe it was primarily due to the expansion of the Ecuadorean artisanal and semi-commercial longline fleet (appendix A3c). (See "Fleet" and "Fleet Operations and Gear".) Many Ecuadorean companies began a major vessel acquisition program in 1990 (appendix A3a and figure 24). Government officials also described increased swordfish abundance off Ecuador in 1990 based on results reported by the fishermen.[187] In addition, Japanese imports increased sharply to nearly 150 t (live weight) (appendix B2d and figure 17). The authors believe that this may have been due to an increasing number of foreign longliners associated with Ecuadorean processing companies. The INP reports increased landings by associated vessels (appendix B2b2), but not nearly as large as the increase suggested by the Japanese import data. There were association contracts for 20 foreign vessels in 1990 (appendix A5a1).

1991: The Ecuadorean Government reported virtually the same catch to FAO in 1991 of 350 tons (appendix B2a and figure 16). Available U.S. import data again confirms this data as shipments totaled about 360 t (live weight) in 1991, only slightly above 1990 levels (appendix B2d and figure 17). Companies continued adding new longliners to the fleet (appendix A3a and figure 24). Oro Marisco, another small company, was opened during 1991 to process and export the catch of artisanal fishermen (appendix A3c). Japan also reported increasing imports of swordfish from Ecuador with shipments totaling nearly 170 t (live weight) (appendix B2d). Expanded Japanese swordfish imports from Ecuador may have been caused by an increase in the number of foreign longliners fishing in association with Ecuadorean companies. This is largely confirmed by sharply increased landings from the foreign associated vessels (mostly Japanese), which grew to nearly 100 t (appendix B2b2). The number of association contracts increased to about 24 vessels in 1991, but some of these were jiggers deployed in the new squid fishery (appendix A5a1 and figure 20).

1992: The Ecuadorean Government continued to report a swordfish catch of 350 t to FAO in 1992 (appendix B2a). The INP reported, however, that Ecuador's domestic fleet caught only 260 t (appendix B2b1).[188] Estimates based on U.S. import data indicate a catch of about 340 t, suggesting that the larger amount reported to FAO may be the most accurate (appendix B2a and figure 16). While the estimates vary somewhat, the 1992 domestic catch appears to have continued at about 1991 levels--although Japanese trade data show a substantial decline (B2d and figure 17). The landings reported by the associated vessels (mostly Japanese) confirm this decline, although the drop in landings is much sharper than the Japanese imports (appendix B2b2).[189] Developments in the fishery indicate a gradual expansion of the new longline fishery. A small company (FRESMAR) was opened during 1992 to process and market the catch of their own vessel and associated vessels (appendix A3c and figure 24). At least four small new longliners were added to the domestic fleet (appendix A3a). The number of association contracts were little changed in 1992 at 24 vessels, but several of these vessels (the squid jiggers) were withdrawn in October when the Government closed the squid fishery (appendix A5a1 and figure 20).

1993: Reports on the 1993 swordfish catch vary substantially. The Ecuadorean Government (presumably the INP) reported to FAO a substantial fall in the swordfish catch to only 33 t for 1993. The INP reported, however, that the domestic catch totaled 265 t, little changed from 1992 (appendix B2b1).[190] Based on U.S. import data, the authors estimate the Ecuadorean annual swordfish catch at about 260 t (appendix B2a). This confirms the decline reported to FAO (but the quantity differs significantly) and is close to the INP catch data (but the trend differs). The authors are unable to reconcile these conflicting reports. Domestic catches probably declined in 1993, but nothing as drastic as the data reported to FAO suggests. Japan reported increased imports from Ecuador which totaled over 100 t (appendix B2d), but the landings of the associated vessels increased sharply to over 90 t (appendix B2b2). The Government reports a substantial increase in the number of foreign vessels operating with Ecuadorean companies, but the vessel types are unavailable (appendix A5b2 and figure 17A). Ecuadorean companies, (such as MARDEX and Oro Marisco) continued acquiring longliners, but they were deployed in directed tuna fisheries (appendix A3a).

1994: Reports on the 1994 swordfish catch also vary substantially. The authors note very sizeable

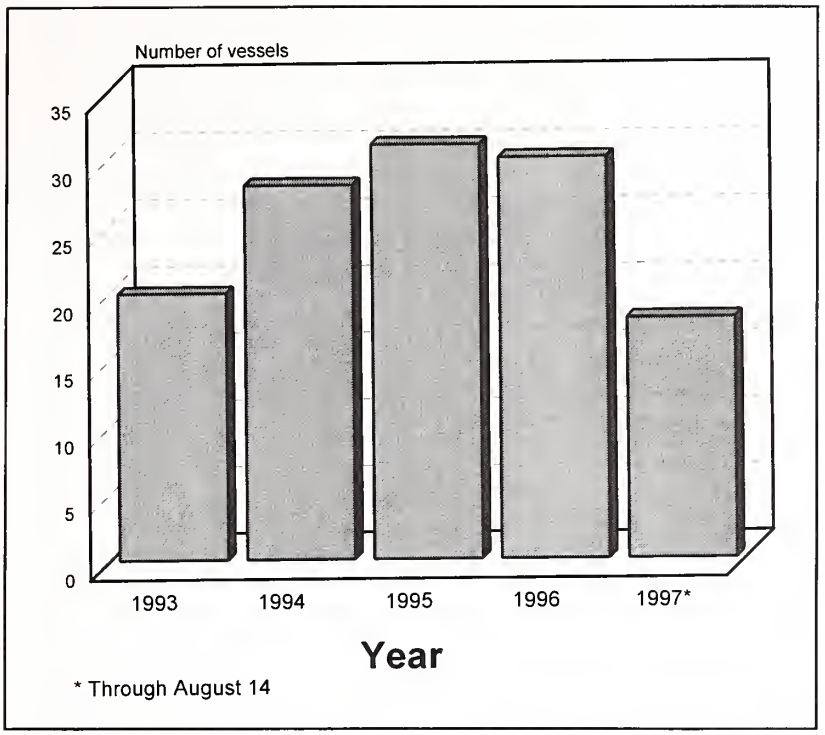

Figure 17A.--The Government in 1994 substantially increased the number of foreign fishing vessels permitted to operate in Ecuadorean waters, but vessel types are unavailable.

differences between Ecuadorean catch data and foreign import data which are unexplained. The Ecuadorean Government reported negligible catches of swordfish to FAO. The INP, however, reported that the domestic catch totaled 450-500 t, a sharp increase from 1993 levels and apparently an all-time record (appendix B2b1-2 and figure 18).[191] The authors cannot confirm this substantial catch increase. Based on U.S. import data, the authors estimate the Ecuadorean annual swordfish catch at about 103 t, suggesting a sharp decline from the estimated 1993 catch (appendix B2d and figure 17). The U.S. import data in 1994 and 1995, however, may not be good indicators of the catch. This sharp decline in U.S. swordfish imports from Ecuador may have been caused by a redirection of some of the catch to the European Union in significant quantities for the first time.[192] Japanese import data totaled over 70 t (live weight), a decline from 1993, but INP landings indicated that the catch of the associated vessels was little changed at about 90 t (appendix B2b2). The authors are unable to explain the discrepancies between the different sources. Several new tuna vessels were added to the fleet during the year (appendix A3a). While the domestic fleet was expanding, several associated foreign longliners withdrew. One local observer reported that only about 18 foreign longliners operated in association with Ecuadorean companies during 1994, compared to an average of 20-25 longliners which operated during the early 1990s (appendix A5a1 and figure 20). More recent Government data shows an increase in the number of foreign vessels (appendix A5a2 and figure 17A), but some of these could be squid vessels.

1995: Ecuadorean catch patterns continue to be confusing. Very significant differences between Ecuadorean catch data and foreign imports continued during 1995. INP officials reported a domestic swordfish catch of over 500 t, relatively unchanged from 1994 (appendix B2b2). The number of domestic, semi-commercial longliners increased in 1995. For example, both LUBAR and TRANSMARINA (which are among the principal fishing companies in Ecuador) acquired several tuna longliners in 1995 and 1996 (appendix A3a and figure 24). In addition, Oro Marisco deployed one of its tuna longliners for directed swordfish operations (appendix A3b). Discrepancies between available sources, however, continue to complicate assessment of catch trends. The Government reported negligible quantities of

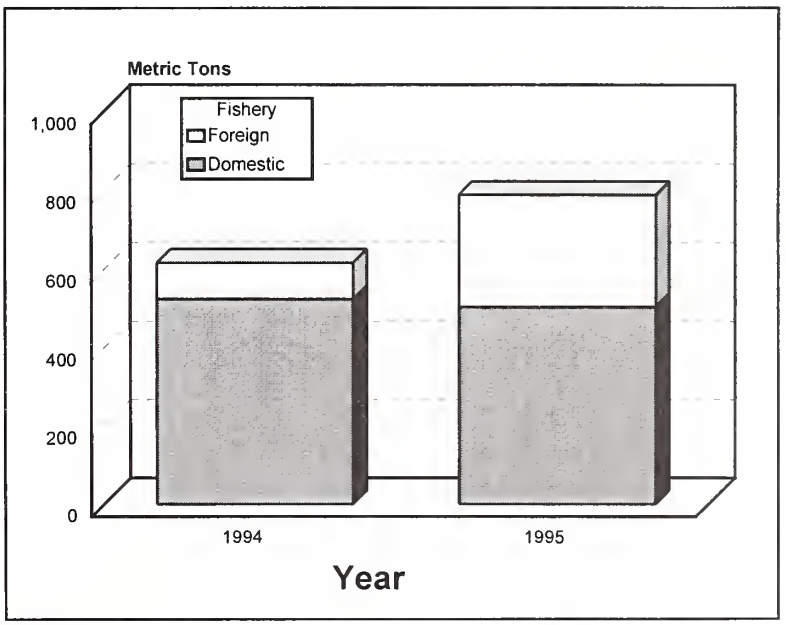

Figure 18.--The INP reported swordfish catches increased in 1995, but because of increased foreign landings, Ecuadorean fishermen reported lower landings.

swordfish taken in 1995 to FAO. In addition, the authors note that the large increase reported by the INP was again not confirmed by foreign import data. U.S. import statistics suggest a catch of only about 100 t, the same as 1994 (appendix B2d).[193] It is highly unlikely that large quantities of swordfish are marketed domestically given the sizeable prince

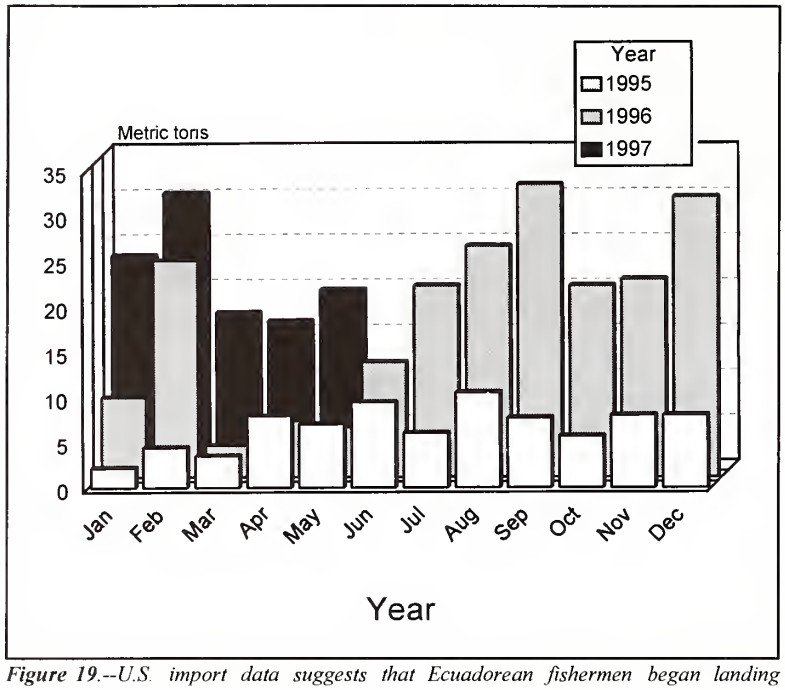

Figure 19.--U.S. import data suggests that Ecuadorean fishermen began landing substantially increased quantities of swordfish beginning in mid-1996.

differences in domestic and export markets. It is possible that some swordfish shipped to the United States is not being properly identified. Developments in the fishery, especially an expanding longline fleet, do suggest possible catch increases. Why those increases are not confirmed by foreign import data is unexplained. The Japanese reported relatively stable imports at nearly 80 t (appendix B2d). The INP reported, however, greatly expanded landings by associated foreign vessels (appendix B2b2). Further complicating the situation, a Government official reported that the total number of foreign longliners operating in association with local companies declined sharply from 18 to only 12 vessels during 1995, substantially below the number in most previous years (appendix A5a1 and figure 20), but other Government data shows an in crease in the number of vessels (appendix A5a2 and figure 17A).[194] The authors are unable to explain these disparities.

1996: Ecuadorean fishermen appear to have significantly increased swordfish catches in 1996. The INP has not yet released 1996 catch data. NMFS estimates based on U.S. import data suggest that the 1996 catch may have approached 275 t (appendix B2d). This suggests a substantial increase over the 1995 catch estimates based on trade, but still far less than the catch reported by the INP in 1995 (appendix B2b2). The fishermen appear to have begun reporting better catches in June when shipments to the United States increased by 130 percent over May and nearly doubled again in July (appendix D2h and figure 19). U.S. import trends are a relatively good reflection of catch trends because most of the product is shipped fresh. Anecdotal reports from ecuador confirm catch increases. Ecuadorean companies reported fleet additions of both foreign and domestic vessels. The number of associated foreign longliners reportedly increased again to about 18 vessels during 1996. At least two companies acquired and deployed new tuna longliners during 1996. LUBAR deployed several 15-m longliners, while PESYMAR acquired and deployed a large 28-m steel-hulled vessel. In addition several companies have deployed six longliners targeting swordfish, especially on new grounds west of the Galápagos (appendix A3b).[195] (See "Fleet".) The increased catch is notable, however, because the Japanese have been reporting somewhat declining stocks in the southeastern Pacific. The Chileans since 1991 have also reported a massive catch decline.[196] (See "Species: Stock assessment".) The increasing Ecuadorean catches appear to be due to the opening of new lightly fished grounds to the west of the Galápagos. Obtaining precise data has proven most difficult. The authors stress that actual INP catch data confirming the NMFS estimates are not available.[197] At least one local observer insists that swordfish catches actually declined in 1996.[198] Given the difficulties obtaining statistics and the fact that almost all of the catch is exported to the United States, the U.S. import data is probably the best available data.

1997: Ecuadorean fishermen continued to report improved catches in 1997. U.S. import data suggests that the fishermen achieved much higher catches in 1997. The 1997 catches have substantially exceeded the relatively high catches reported in 1996. The sharply higher 1996-97 results demonstrate the growing interest in swordfish on the part of the

Ecuadorean fishermen. Shipments were especially strong in January and February and although they have declined somewhat in March-May, but since May have begun increasing again. Imports are well above normal levels (appendix D2h). Swordfish imports through July totaled over 170 t, or about 250 t (live weight). This would suggest shipments of about at least 300 t or 430 t (live weight) for the full year. This is a substantial increase over the quantity imported during the same period of 1996 (appendix D2h). The expanding domestic fishing effort on swordfish appears to be the major reason for the increase, but the warming water temperatures in the ETP associated with the powerful developing 1997 El Niño may also be a factor. Some reports suggest, however, that artisanal longline fishermen operating along the mainland coast are experiencing very poor catches of swordfish and other oceanic pelagics. One company working with the artisanal fishermen in mid-1997 indicated that the fishermen were landing small quantities of dorado, but little else.[199] Notably the number of foreign vessels working in Ecuadorean waters appear to have declined in 1997 (appendix A5a2 and figure 17A).[200]

VIII. Ports

The principal Ecuadorean port is Guayaquil. Guayaquil is, however, not located along the coast, but rather some distance up the Guayas River from the Gulf of Guayaquil. Much of the commercial fishing fleet, except shrimp trawlers, is thus based in Manta and a few other coastal ports located directly on the Pacific coast. The artisanal fishermen operate from a very large number of coastal towns and villages, although much of the fleet is centered in a relatively small number of ports (appendix A1 and figure 11). Much of the more advanced artisanal and commercial fleet operates from Manta.

Esmeraldas (Esmeraldas): This port town is located along the northern coast, approximately 250 km north of Manta. Although there is only one major fishing company located in Esmeraldas (CONSEMAR), various individual boat owners land their catch there. It is a major artisanal port (figure 11). According to a local observer, approximately 8 (10-12 m) sailboats and 38 (15-28 m) wood vessels conducted longline operations out of Esmeraldas during 1996. According to this observer, local artisanal and semi-commercial fishermen land about 130 t of swordfish per year. CONSEMAR's annual swordfish catch (20 t), is exported directly by the company. The other companies landing swordfish in Esmeraldas, packed the fresh H&G trunks in ice and truck it to Manta where it is sold to processing/exporting companies for export.[201]

Guayaquil (Guayas): Ecuador's largest city and principal port is Guayaquil. The country's commercial shrimp fleet is primarily based in the Guayaquil area, much of it operating from nearby Durán. Longliners do not operate from Guayaquil as they would have to enter the Gulf of Guayaquil and move up the Guayas river, significantly increasing time away from the fishing grounds.

La Libertad (Guayas): La Libertad is located approximately 100 km west of Guayaquil, about 120 km south of Manta, and only about 10 km east of Salinas. The port is located in a small bay, providing a protected anchorage of relatively calm waters. This protected setting has made this port a popular landing and re-supply site among many artisanal and semi-commercial Ecuadorean fishermen.[202] Some associated foreign vessels have landed their catch at La Libertad and a few are reportedly doing so in 1997.[203]

Manta (Manabí): Manta is Ecuador's principal fishing port. It is located to the northeast of Guayaquil, along the northern coast of Cabo San Lorenzo. Manta is an excellent "natural" port. It's location in Manta Bay, a relatively large protected bay, provides a protected anchorage. The port of Manta has several advantages over the larger port of Guayaquil. For example, captains can maneuver their vessels to the pier in only about 15-20 minutes, while in Guayaquil, large vessels have to be towed into port by tugboats, which can take up to 6 hours. Most importantly, Manta is located directly on the Pacific coast.[204] The country's tuna fishery and other finfish fisheries are mostly based in Manta (photo 29). This port serves as the primary base for both the Ecuadorean tuna purse-seine fleet and the local and foreign longline fleets. For this reason, a substantial part of Ecuador's tuna and swordfish catch is handled at Manta. Manta is located north of the Gulf of Guayaquil, and as the western-most Ecuadorean port, it is the closest to the major pelagic fishing grounds. The existing port facilities were completed in 1968.

Photo 29.--Domestic tuna vessels, both seiners and baitboats, based in Manta. Boris Buenaventura

***Photo 30** --Some sailboats or "balandras" used by the artisanal fishermen operate out of Manta. Some of Ecuador's most advanced artisanal operations are conducted out of Manta. B. Buenaventura*

The pier is about 1,800 m in length and it can accommodate cargo vessels (in excess of 3,000 tons). Port authorities in 1996 were discussing modernization plans that would allow the port to accommodate a new generation of vessels, of 3,000 tons and above. The port of Manta has a large jetty that extends 1,800 m into the ocean with three lateral piers that serve as landing sites for the longliners.[205] One of these piers is called Marginal #1 and is 150 m long. Marginal #2 measures 100 m, while Marginal #3 measures a total of 150 meters.[206] On these piers, port authorities as well as some private companies operate lifts that facilitate landing the catch. Individuals operating tank trucks supply the vessels with fresh water. Although the port of Manta has warehouses, it does not have any cold stores.[207] Several fishing companies, however, have their own cold stores. Most of the fresh exports are trucked about 200 km (about 3.5 hours) to the Guayaquil airport, located southwest of the city. There are direct flights from Manta to Miami, but the small number of flights limits the quantities shipped. There is also considerable competition with flower exporters for the available space.[208] Manta is one of Ecuador's principal artisanal ports (figure 11). Artisanal fishermen targeting tuna are especially active at Manta (photo 30). There is a jetty in Manta which was designed to service the artisanal vessels, although it is not functional because of severe sedimentation problems. There are plans to build an artisanal fishing port next to the main jetty where the commercial piers are located. The Japanese International Cooperation Agency (JICA) and Ecuadorean Government officials have estimated the cost of the project at $19 million. JICA supports the construction of the pier, but, due to unspecified political problems the project is currently on hold.[209] Much of the catch of the associated foreign vessels (appendix A5a1) is landed at Manta.[210]

Puerto Bolívar (El Oro): This port is located in the southern province of El Oro, just west of the provincial capital of Machala. The primary fishing activity is for shrimp. There is considerable artisanal activity at Puerto Bolívar (appendix A1 figure 11), but swordfish landings are minimal.

Salinas (Guayas): Salinas is located about 110 km west of Guayaquil and about 150 km south of Manta. It is an important seaside resort and the center of Ecuador's small sport fishery. A considerable number of small-scale artisanal fishermen use the Santa Rosa fishing port near Salinas (photos 31 and 32). There is little commercial fishing fishing activity at Salinas where the tourist industry dominates the local economy .

Photo 31.--Artisanal fishermen landing their catch at the Santa Rosa (Salinas) market. Alexandra Paez

Photo 32.--View taken from within the Santa Rosa (Salinas) fish market. Alexandra Paez

Santa Cruz (Galápagos): Some of the longliners operating to the west of the Galápagos since 1996 have been landing their fresh catch, especially swordfish, at Santa Cruz. The fish is then air shipped to the Guayaquil airport and then on to the U.S. market.[211]

Santa Elena (Guayas): This port is located about 10 km east of La Libertad, and about 20 km east of Salinas. Although it is primarily utilized for oil export operations, Santa Elena has served as a base for a few associated foreign longliners and a small shrimp trawler fleet. Six Japanese longliners were based at Santa Elena during 1997.[212]

Others: There are several other smaller ports in Ecuador, such as Anconcito, Jama, Puerto López, San Mateo, and Santa Rosa/Salinas, where artisanal fishermen land their catch (figure 11). However, the quantities of swordfish landed at these ports by the artisanal fishermen are minimal (appendix A1).

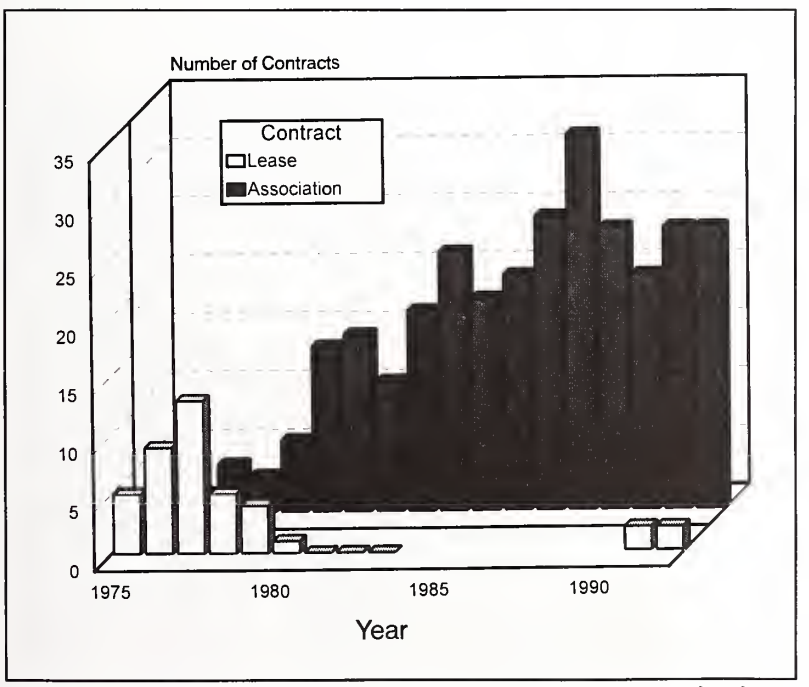

***Figure 20**.--Associated vessel contracts are the primary mechanism for foreign participation in the Ecuadorean fishery.*

IX. Transshipment

Ecuador does not permit foreign fishermen to transship their catch through the country's ports or in jurisdictional waters. There is some foreign-caught fish, however, flowing through Ecuadorean ports. The foreign (mostly Japanese vessels) operating off Ecuador, in association with Ecuadorean companies, are required to land their catch in authorized ports. Most of this activity takes place at Manta, although there is currently some limited activity at other ports.[213] While these shipments are not legally transshipments, they are for all practical purposes transhipped product. The authors believe that some of the frozen imports reported by the European Union and Japan may be the landings of the associated foreign longliners (appendices A5a1-2, B2a, and B2b2 and figures 17, 18, and 20). The landed fish is technically sold to the associated Ecuadorean company and Government officials consider it to be an Ecuadorean export. (See: "Exports.") Much of this product, however, is marketed in Japan with the assistance of the associated fishing company.

Foreign fishing vessels may travel through Ecuadorean waters ("paso inocente") as long as they do not fish. The Ecuadorean Government requires that foreign fishermen obtain authorization for such passage and report what they are carrying. The United States and several other countries, however, have objected to these limitations on innocent passage.

X. Processing and products

Ecuador's seafood processing industry has focused largely on canning sardines and tuna and freezing shrimp (increasingly cultured product) for export. In recent years the industry has expanded the production of high quality fresh and frozen finfish. Processors now handle substantial quantities of dorado (mahi-mahi), tuna, seabass, squid, and other species, including swordfish.

A. Fresh

While few details are available, the processing of fresh fish has expanded significantly since the 1980s. Formally shark and often large pelagics were simply butchered on the beach for local sale (photo 33). Ecuadorean companies are now handling fresh fish, including tuna, swordfish, shark, and other species. One reflection of this is readily observable in the quantities of fresh fish exported to the United States. The processing of fresh tuna and swordfish generally occurs on the motherships and large commercial longliners. Smaller artisanal boats (fibras) deliver their catch to these vessels. The swordfish is then headed, gutted, and stored in an ice-water slurry at about 0°C.[214] Upon arrival at Manta, the swordfish is unloaded, placed in insulated containers with "gel-packs," and transported in refrigerated trucks to the Manta airport which is about 15 minutes (8 km) from the port, or the Guayaquil airport, which is about 3.5 hours away by truck.[215] Some swordfish is also delivered by air from Santa Cruz on the Galápagos Islands.[216] Most of the swordfish exported by the Ecuadorean companies is marketed as fresh trunks (H&G) in the United States (appendices D1a and D2a and figure 21 and 22). The authors, however, noted in 1997 that, for the first time, swordfish shipments to the United States also included small quantities of fresh steaks. Oro Marisco, for example, is one of the few Ecuadorean companies that has started exporting value-added swordfish products such as loins and steaks. (See "Companies".)

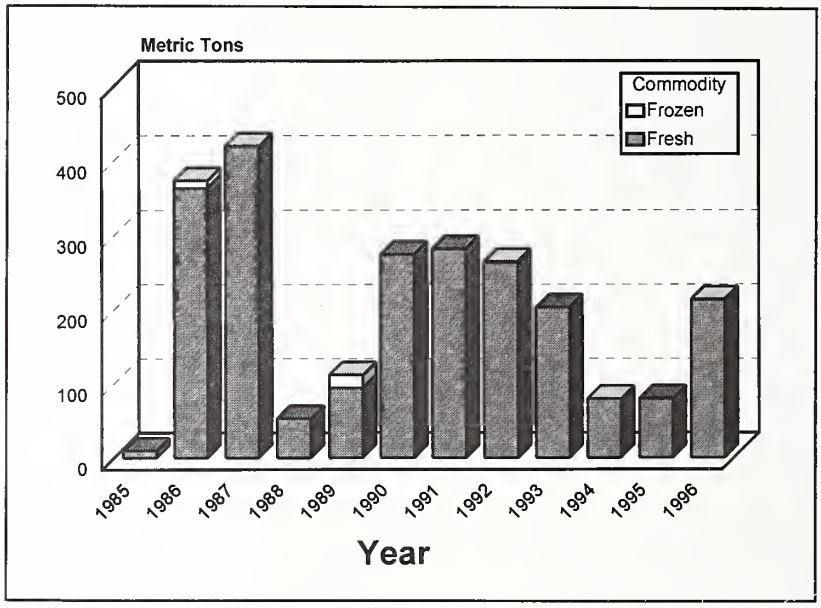

***Figure 21**.-- Almost all of Ecuador's swordfish exports to the United States are shipped as fresh product. Exporters sharply increased quantities shipped in 1996.*

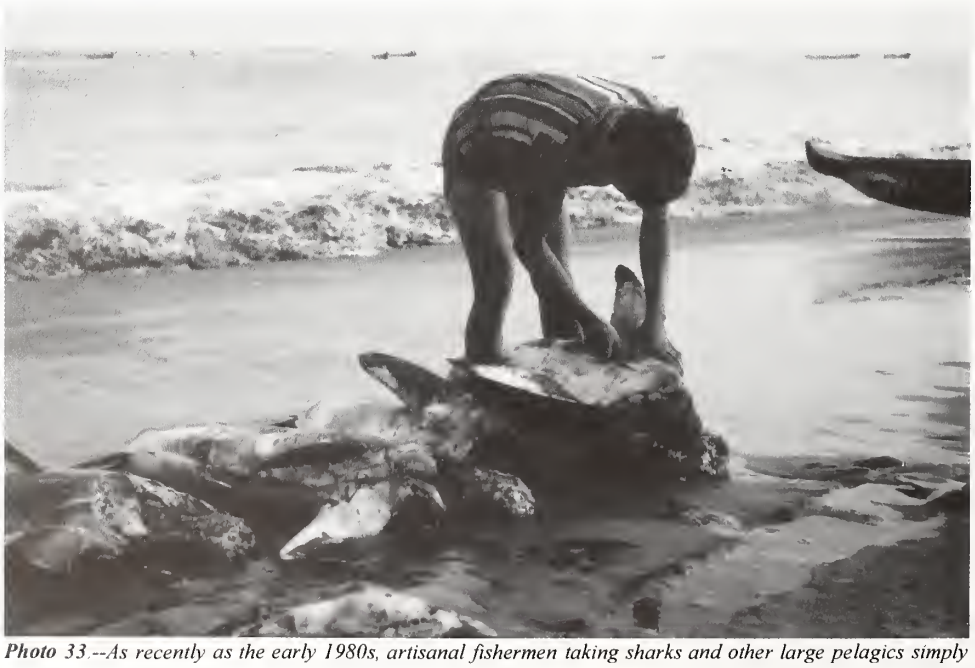

***Photo 33**.--As recently as the early 1980s, artisanal fishermen taking sharks and other large pelagics simply butchered them on the beach. Dennis Weidner*

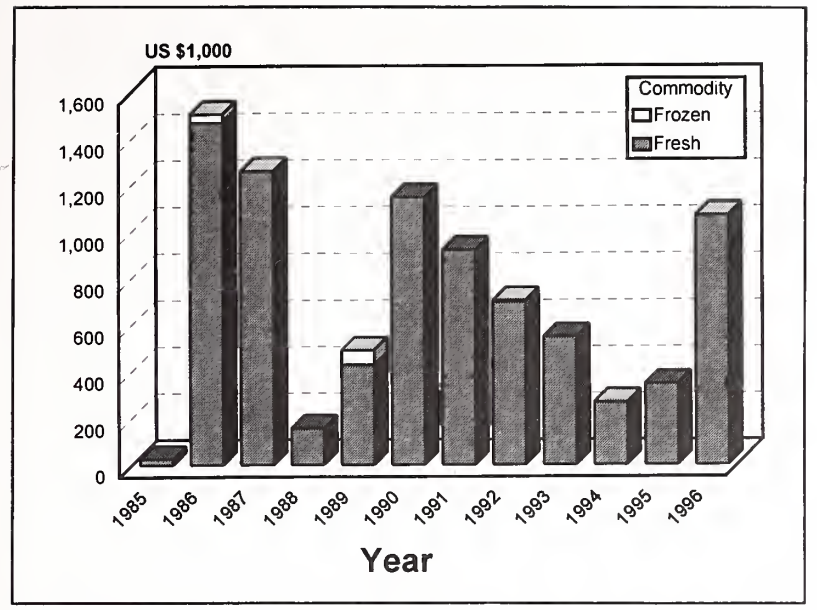

***Figure 22**.--Ecuadorean swordfish exports to the United States increased sharply in 1996, especially the value of shipments.*

Shipments of fresh steaks through August 1997 reached 1.7 tons. While only a minimal (1 percent) proportion of 1997 shipments, such processing represents a significant departure from the simple shipping of unprocessed H&G trunks.

B. Frozen

Ecuador's cold storage capacity and the quality standards of major companies have increased significantly in recent years to accommodate the expanded production of cultured shrimp and high-quality finfish.[217] Most of the export-grade swordfish is exported fresh, although some of the catch is frozen. Little of the swordfish is processed. Almost all of the frozen product is shipped as trunks (H&G). Some swordfish and other billfish is frozen for the Japanese market. Based on Japanese trade data, approximately 400 t of frozen billfish (including marlin and swordfish) were imported from Ecuador in 1996 (appendix E3a). The authors believe that most of the frozen tuna and billfish exported has been landed by the foreign longliners operating out of Ecuador. The expanding domestic longline fleet, however, may supply increasing quantities of ocean pelagics to Japan in the future. No details are available on the processing aboard the foreign vessels, but it is probably similar to normal Japanese handling procedures.[218] The EU reports importing substantial quantities of frozen swordfish, about 80 t in 1994, but the authors have been unable to confirm such large shipments with Ecuadorean sources (appendix D4). According to EU trade data, EU countries continued to import frozen swordfish (approximately 45 t) in 1995 (appendix D4). Very little swordfish is frozen for the U.S. market (appendix D2a).

***Photo 34**.--Ecuadorean companies now produce high-quality fresh and frozen product meeting the quality standards in export markets. Alexandra Paez*

XI. Companies

A. Trade associations

Fisheries is one of Ecuador's leading economic sectors. Several trade associations represent different sectors of the economy. These associations vary greatly as to their activities, staff, and capabilities. There are no groups specifically concerned with swordfish, but two industry groups are involved with highly-migratory species in general:

ASO-EXPEBLA: Ecuadorean companies exporting finfish have formed an association, the Asociación de Exportadores de Pesca Blanca (ASO-EXPEBLA), to assist in marketing efforts. The Association in 1996 consisted of 17 companies (appendix C1). The companies operate mostly out of Manta, Ecuador's principal tuna port. They handle a variety of fresh and frozen finfish (mostly bigeye tuna, mako and thresher shark, dorado, and blue marlin), as well as small quantities of swordfish (appendices D5a and D5b).

Asociación Ecuatoriana de Armadores de Barcos Pesqueros y Camaroneros (ASERBAPESCA): This trade association represents the interests of Ecuadorean commercial fishermen. The association attempts to influence government regulations affecting the fishery industry. Currently, it is trying to convince the Government to restrict the use of driftnets.[219] The Association is also promoting a major revision of Ecuadorean fisheries legislation. Juan Carlos Correía, President of the Asociación Ecuatoriana de Armadores de Barcos Pesqueros y Camaroneros, insists that it is urgent that the country has a true fisheries law that would protect and regulate the fisheries sector.[220]

ATUNEC: The Asociación de Atuneros de Ecuador was established in Manta during 1994 to represent the interests of the Ecuadorean purse-seine tuna fishermen and to promote that fishery in general. Among ATUNEC's current activities are efforts to obtain Government support for modernizing the tuna fleet. Like the other associations, ATUNEC is promoting efforts to enact a comprehensive, modern fisheries law. ATUNEC representatives complain that the current law was enacted in 1969 and does not reflect the significant expansion of the industry in recent years. ATUNEC's membership includes most important Ecuadorean owners of tuna purse-seiners (appendix A4).

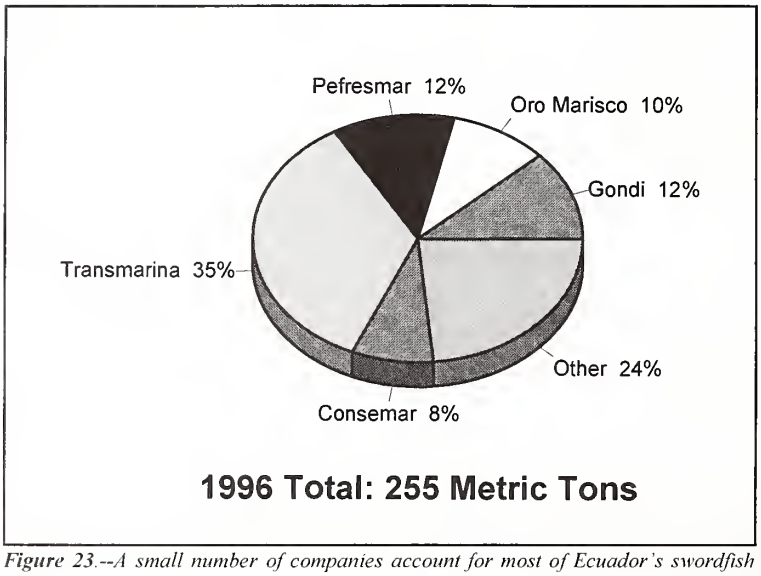

Figure 23.--A small number of companies account for most of Ecuador's swordfish exports.

B. Companies

Established Ecuadorean fishing companies have been involved in the tuna purse-seine fishery for years. Initially they canned the catch and exported frozen tuna to foreign canneries. In the 1980s they began exporting pre-cooked loins. More recently several new companies have initiated a longline fishery targeting tuna as part of a larger operation to supply high-value fresh product. Swordfish catches have been limited and incidental to the directed tuna operations. The Ecuadorean companies conducting longline and/or fresh seafood export operations, however, are now becoming more involved with swordfish and several companies have initiated directed swordfish operations.

A small number of Ecuadorean companies handle significant quantities of swordfish, either by longline fishing or processing the longline catch. The single most important is Transmarina, but several other companies play important roles (CONSEMAR, Gondi, Lubar, Oro Marisco, and Pefresmar) (appendix C1 and figure 23). Much of the longlining activity has taken place since 1990 (appendix A3c and figure 24). Some companies (FRESMAR, Gondi, and Pefresmar) are involved in all aspects of the longline fishery, fishing, processing, and exporting. Other companies specialize in fishing (Consepac, EMPROOCEANIA, Lubar, MARDEX, Pesquera Reyes, Oro Marisco, Pesquera Reyes, and TRANSMARINA), processing (CONSEMAR,

PEFREEXPORT and Pesca Fresca), and marketing/exporting (AGROL, CONSEMAR, and Pesca Fresca). There is only limited joint venture activity (PESYMAR and TRANSMARINA). (See "International".) Several companies (Ecuafresco, CONSEMAR, Lubar, PESYMAR, and USTI), however, are or have been associated with foreign companies through association contracts. (See "Government Agencies and Policies: Licenses".) Some of Ecuador's largest, most established fishing companies (including Conservas Isabel Ecuatoriana, EMPESEC, INEPACA, and SEAFMAN) are involved in the processing of the tuna caught by the country's large fleet of small purse seiners. These companies have, for the most part, not entered the longline and other fisheries for tuna, swordfish, and other species for export as high-value fresh product.

Details on the companies involved in the longline fishery or processing and exporting the longline catch are as follows:

AGROL: This Manta-based company was established in 1995. The company is primarily an exporter, but operates one tuna vessel. It is the exporting sister company of Pesquera Reyes. The company exports mostly bigeye tuna, which is the target species of Pesquera Reyes' longline fleet. Agrol does own a 600 t tuna purse seiner, the *Miry Ann D.* This company buys and sells only export-quality product. Agrol exports approximately 670 t of fresh bigeye (H&G) to the United States per year. Most of the by-catch (species such as mako shark, striped marlin, thresher shark, and yellowfin tuna) are sold fresh locally. The company's major client (buying about 50-70 percent of Agrol's product) is Mitsubishi McFresh, which has offices in New York, Miami, and Seattle. Part of the *Miry Ann D*'s tuna purse-seine catch is exported frozen to canneries in Europe and the United States. The remainder is sold to various Ecuadorean canneries, such as Empesec, Real, and Tunlo. AGROL does not export swordfish. Its affiliated supplier, Pesquera Rey, sells all its swordfish catch to Gondi. According to company officials, since the mid 1980s swordfish catches have significantly declined, apparently due to a change in prevailing current conditions.[221] Other companies, however, have reported improving swordfish catches in recent years.

American Cargo: This company is associated with the various Ecuadorean fresh seafood exporters. Its major function is to identify and reserve available air cargo space for the exporting companies.[222]

CONSEMAR: This Esmeraldas-based company was established in 1984. CONSEMAR is involved in processing and exporting operations. Although it does not own its own vessels, CONSEMAR has established association contracts with various Japanese longliners to obtain raw material. (See: "International: Joint ventures".) The primary species marketed by this firm are dorado, grouper, snapper, and swordfish. Most of the swordfish processed is exported as fresh H&G

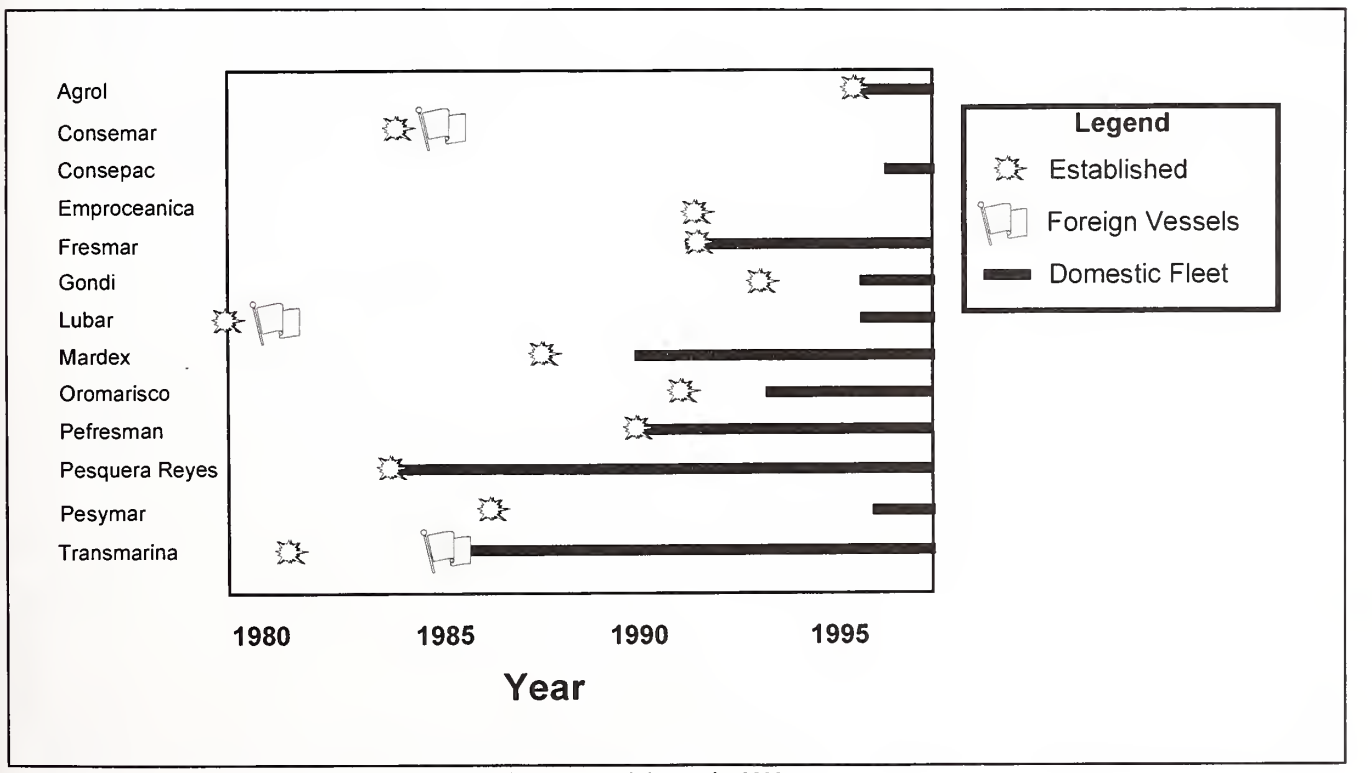

Figure 24.--Most of the Ecuadorean longline fleet has been acquired during the 1990s.

trunks to the United States. CONSEMAR exports an average of 20 t of swordfish per year.[223]

CONSEPAC: This Manta-based company is initiating a longline fishery off the Galápagos. It has reportedly obtained a 1-year permit to operate the large commercial longliner, *Nautilus*, and four high-speed fiberglass launches off the Galápagos. The exact nature of their permit is unclear, although the vessel is equipped for high-seas fishing. No details are available on actual fishing operations, but a marlin has been observed on one of the launches.[224] These operations have been sharply criticized by ecological groups concerned about the Galápagos ecosystem.

Ecuafresco: This Manta-based company was established in 1993. The company is involved in fishing, processing and exporting. Although Ecuafresco itself does not own any vessels, it works with 11 domestic associated longliners which supply raw material (appendix A3a). The processing facilities have a capacity of 22 t per day. The company's principal products are bigeye tuna and dorado. All the tuna is exported to the United States as fresh H&G, while the Dorado is marketed frozen. Ecuafresco was trying to sign association agreements with additional vessel owners to increase the supply of raw material in 1996. Among other species marketed by the company are marlin, shark, snapper, squid, and swordfish. According to company officials, the swordfish catches of associated fishermen were minimal, primarily because the fishermen can not reach productive offshore grounds in their small vessels. Since swordfish deliveries are minimal, the company does not export this species, but rather sells the small quantity product to other local exporters.[225]

***Photo 35**.--Several Ecuadorean companies now produce high-quality product meeting export-grade standards. Quantities of swordfish have been limited, but are increasing in 1996-97.*

EMPROCEANICA: This Manta-based company, which was established in 1991, operates three purse seiners and four longliners. The company owns the purse seiners and operates the longliners under contract. The tuna catch totals 10,000 t (primarily albacore, bigeye, and yellowfin) tuna. The three 350-ton purse seiners, *Sajambre*, *Ribadesella*, and another unknown vessel, are responsible for landing the bulk of the company's total catch. The company exports the purse-seine catch to the United States and Europe.[226] In addition to exporting the catch of their company-owned vessels, EMPROCEANICA also exports the tuna it purchases from various artisanal fishermen.[227] EMPROCEANICA is associated with two other companies, Pesca Fresca, and PECIA. It operates Pesca Fresca's four longliners (*Nautilus*[228], *Lashkmy 1*, *Lashkmy 2*, and *Centauro*). The four longliners are deployed in the tuna fishery (appendix A3a). The catch is maintained on ice and is exported fresh, mostly to the United States. EMPROCEANICA contracts Pesca Fresca to handle the export of the longline catch. There is probably a small swordfish by-catch from the longliners but no details are available.

FRESMAR: This Manta-based company was established in 1992 and is involved in fishing, processing, and exporting. The company, which targets mainly bigeye tuna and dorado operates one longliner, *Altair* (appendix A3a). Only small quantities of swordfish are landed incidentally. FRESMAR also purchases bigeye tuna and dorado from various artisanal fishermen at different artisanal landing sites. The company's processing capacity is approximately 13 t of fish per day.[229] The company exports fresh H&G bigeye and fresh and frozen dorado (H&G and fillets) to the United States. In 1995, FRESMAR exported approximately 750 t of fresh bigeye tuna and about 560 t of dorado (both fresh H&G and frozen fillets). According to company officials, Ecuadorean artisanal fishermen do not target swordfish and therefore only small quantities of this species are delivered by the fishermen. The small quantity of swordfish that is caught is exported as fresh H&G and loins to the United States. The company exported an average of about 11 t of swordfish per year during 1993-1995. Exports in 1996 totaled about 1.5 t as of May.

Gondi: This Manta-based company was established in 1993 and is currently involved in fishing, processing, and exporting operations. In addition to

marketing the catch taken by its four vessels (*Alfonso Gregorio*, *Angelica Maria*, *Don Javier*, and the *Sajea*), Gondi purchases the catch of artisanal fishermen landed in several sites such as Esmeraldas, Jama, Manta, Puerto López, and Santa Elena, among others. The company also purchases and markets a percentage of AGROL's catch. Gondi primarily targets bigeye tuna and dorado. The catch is composed of bigeye tuna (approximately 75 percent) and dorado (5-20 percent, depending on the season). Small quantities of blue and striped marlin, sharks, and swordfish are also taken. According to company officials, Gondi exports about 30 t of swordfish per year as fresh (H&G) to the United States. Some of the other by-catch species, such as part of the shark catch, is marketed domestically. Company officials estimate the total annual exports at about 455 tons. Most of these exports (approximately 85 percent) are marketed fresh (H&G) in the United States, while the highest quality bigeye (15 percent) is marketed fresh (H&G) in Japan.[230]

***Photo 36**.--One of the Ecuadorean companies involved in the catching, processing, and exporting of high-quality fresh fish is MARDEX. Otto Schwarz*

LUBAR: This Manta-based company was established in 1976 and is currently one of the largest Ecuadorean fishing companies. LUBAR is involved in fishing, processing, and exporting operations. The company operates 13 longliners (appendix A3a). In addition to the catch landed by their own vessels, the company purchases raw material from other longline fishermen. LUBAR is also associated with several foreign longliners. The Navy seized one of the associated vessels, the *Tenyu Maru 38*, in 1989 as a result of charges concerning shark finning.[231] LUBAR is currently associated with a Canadian vessel and has previously been associated with Japanese longliners. The authors, however, do not have detailed information on these contracts. Lubar's primary target species is bigeye. Small quantities of dorado, mako shark, marlin, swordfish and thresher shark are also taken. The company also cans and exports sardines and tuna. LUBAR's total processing capacity is about 13 t per 8-hour shift. Swordfish catches are very limited. The company exported only 7 t of swordfish in 1995. All of the swordfish marketed is exported as fresh and frozen H&G to Miami.[232]

MARDEX: This Manta-based company was established in 1987. It is a vertically integrated company involved directly in fishing, processing, marketing, and exporting (photo 36). The company owns a total of nine longliners (appendix A3a). MARDEX also purchases raw material from fishermen. The company's freezing plant has a capacity of 24-36 t/day. Fishing/processing operations are divided into two annual phases. During the winter (May-August), the company's major export product is frozen dorado fillets. The dorado fishery, however, is highly seasonal. The large quantities caught in Ecuador and other countries during this season cause prices to fall. The company takes advantage of the seasonally low raw material prices to produce frozen fillets for export. The relatively low market prices for frozen fillets require very inexpensive raw material. When prices rise during the off season the company has to suspend production of frozen product. Most of the frozen dorado fillets are exported to the United States. During the rest of the year (September-April) much of the catch (such as dorado, bigeye, mako and thresher shark, wahoo, and swordfish) is exported as high-priced fresh product to the United States. Other species caught by the MARDEX longliners (such as marlin and various shark species, other than mako and thresher) are marketed domestically. The company exports some of its fresh tuna catch to Japan. MARDEX exports a total of about 135 t of fish per month (1,620 t/year). Only about 1.5 t/month (18 t/year) of that total is swordfish. Most of the swordfish is exported as fresh H&G to the United States. Mardex purchased and exported

some of Pesquera Reyes' bigeye, marlin, dorado, shark, and swordfish catch from 1987-1993. Differences between the two companies, however, resulted in the termination of their association in 1993.[233] MARDEX currently also purchases other species (such as butterfish, corvina, and sardines) supplied by the artisanal fishermen and markets them domestically, mostly as frozen product.[234]

Oro Marisco: This Guayaquil-based company, which was established in 1991, is involved in fishing, processing, and exporting operations. The company owns one longliner, the *Don Casi II* (appendix A3a). The company also has established association agreements with three other longliners. The *Don Casi II* is the only Ecuadorean semi-commercial longliner primarily targeting swordfish. It deploys a longline of 40 km and operates up to 1,600 km off the Ecuadorean coast in trips lasting around 20 days. The company can process up to 600 t of fish per year. Oro Marisco exports approximately 25 t of swordfish per year and is one of the few Ecuadorean companies processing swordfish. Most of the swordfish is exported as H&G fresh to the United States. Some of the catch, however, is processed as loins and exported to Europe (mainly Germany, France, and the United Kingdom). Other species processed and marketed fresh and frozen by the company are dorado, shark, and squid, among others.[235]

PEFREEXPORT: This Manta-based company was created in 1995. PEFREEXPORT is involved in processing and exporting. Although it does not own any vessels itself, the company is associated with four local vessel owners, which operate 10 longliners to obtain raw material (appendix A3a). PEFREEXPORT markets a variety of fish (such as bigeye, dorado, marlin, swordfish, and wahoo). According to company officials, most of the associated vessel catch is bigeye (approximately 60 percent) and the only small quantities of swordfish (2 percent). Currently, the company is leasing its processing facilities. Company officials acquired their own new processing facilities in 1996. The new processing facilities will allow the company to process about 22 t of tuna and other species per day. All the swordfish processed by the company (about 9 t per year) is exported as fresh H&G to the United States.[236]

Pefresmar: This Manta-based company, which was established in 1990, is involved in fishing, processing, and exporting. The company owns two longliners, the *Nizan* and the *Barco de Progreso* (appendix A3a). Like many of the Ecuadorean fishing/processing companies, PEFRESMAR also finances the fishing operations of associated domestic vessels supply raw material. PEFRESMAR is associated with 28 local individuals each of whom operates a small longliner. The company purchases the catch of the associated vessels fishing under contract. The company's two longliners and 28 associated vessels primarily target bigeye tuna, although dorado, mako and thresher shark, marlin (blue and striped), sailfish, swordfish, and wahoo are also taken. A company official estimated that swordfish catches average only about 5 percent of the total annual catch. This amounts to approximately 30 t of swordfish per year. Most of this swordfish is exported as fresh H&G to the United States. Most of the bigeye, which comprises about 75 percent of the catch, is exported as fresh H&G to the United States, but smaller quantities are also exported to Japan. The company also produces frozen products (such as fillets) which are both marketed domestically and exported.[237]

Pesca Fresca: This Manta-based company was established in 1991. Originally, Pesca Fresca was a division of PECIA, a company established in 1972 to farm shrimp. Pesca Fresca, a vertically-integrated company, processes and exports fresh tuna to the United States and Japan. The company is the leading Ecuadorean exporter of tuna. It owns four small semi-commercial longliners, and is associated with 15 other similar vessels and a total of 150 artisanal "fibras." The company also owns a large factory boat which is used as a mothership to receive the catch from the associated vessels at sea. This ensures a high quality product. More than 135 t of tuna are exported monthly. The high-quality product is used for sushi and sashimi.[238] All the bigeye is exported to Japan or the United States. Small quantities of swordfish are also bought from associated vessels and exported as fresh H&G to the United States. Pesca Fresca is associated with EMPROCEANICA and also contracts with the seafood broker company American Cargo to reserve air cargo space for fresh exports.[239]

Pesquera Reyes: This Manta-based company was established in 1984. It is involved in fishing and marketing and is affiliated with Agrol. The company acquired 15 "fibras" during the early 1980s and started targeting bigeye, marlin, dorado, sharks, and swordfish with longlines. Pesquera Reyes initially sold most of its catch to MARDEX which processed and exported the catch. Pesquera Reyes in 1987 acquired Manta's first commercial longliner. After working with MARDEX for several years, Pesquera Reyes in 1993 terminated its association and began selling its catch to another fish exporting company, Mardelit. Due to legal problems the association between Pesquera Reyes and Mardelit was dissolved in 1995. Pesquera Reyes then began to export its own catch through a new affiliated company, Agrol. Pesquera Reyes as of 1997 operated one of Ecuador's largest fleets. The company's fleet included commercial wooden-hulled longliners (29), sailboats (which also deploy longlines) (8), and fiberglass

vessels (about 100) (appendix A3a.) (See "Fleet".) The company claims it has "the best fishing fleet in Manta." Pesquera Reyes sells its catch through Agrol (50-70 percent) of and most of the remainder to Gondi. The company markets some non-export-grade fresh product (marlin, tuna, wahoo) domestically through supermarket chains in Guayaquil, Quito, and other large cities. According to company officials, their annual swordfish catch of their vessels is very low, only about 9 tons--all of which is sold fresh to Gondi.[240]

PESYMAR: This Manta-based company was established in 1986. It is involved in fishing, processing, and exporting. PESYMAR is affiliated with a New Zealand-owned company, Prime North Corporation through the joint-venture company Prime North Ecuador. PESYMAR exports the catch of the vessel operating for Prime North Ecuador, the *Kona Wind,* a 28-m steel-hulled longliner registered under the New Zealand flag. The affiliated company owners are in the process of registering this vessel in Ecuador. PESYMAR exports several species of fish (including bigeye, dorado, marlin, and mako, thresher shark, and swordfish among others). Based on estimated swordfish catch rates provided by company officials, the authors believe that PESYMAR exported about 11 t of swordfish during 1996. All the swordfish is exported as fresh H&G to the United States. PESYMAR in 1996 initiated a new bottom longline fishery to target demersal species such as grouper and corvina. The company has also started producing small quantities of vacuum-packed value-added products such as fish and shrimp patties, as well as seasoned fillets.[241] The *Kona Wind*, during early 1997 was deployed on fishing grounds west of the Galápagos Islands to target bigeye and swordfish. According to company officials the average catch per 22-25 day trip during early 1997 yielded approximately 2 t of swordfish, 1 t of bigeye, 1 t of striped marlin, 1 ton of dorado, and 3 t of shark (blue, brown, and mako) (figure 14). PESYMAR expects to deploy the vessel 11 times during 1997.[242] If successful, the company would land around 20 t of swordfish.

Prime North Ecuador: This Manta-based joint-venture company was established in 1996 through an affiliation between Prime North Corporation (a New Zealand company) and PESYMAR (the Manta-based company described above). Prime North Ecuador operates a 28-m steel hulled longliner, the *Kona Wind*, which is owned by the Prime North Corporation (photo 23). Through the association between Prime North and PESYMAR, *Kona Wind's* catch is sold to and exported by PESYMAR. Prime North Ecuador's target species are bigeye and swordfish. PESYMAR hopes that the association with the New Zealand company will help open the Japanese market because the New Zealanders have considerable experience exporting to Japan (photo 27).[243]

PROMAROSA: This Salinas/Santa Rosa-based company was established in 1986 (photo 37). It is involved in processing and exporting operations. The company has decided to focus entirely on processing and exporting rather than actual fishing operations. As a result, it sold its boat and now purchases all raw materials from artisanal fishermen. Company officials report that this focus on processing allows it to produce some of Ecuador's highest quality product. They maintain that unlike some other companies, they have decided to concentrate on quality and not quantity.[244] The major export markets are the United States, the European Union (Germany, France, and Spain), Australia, and Japan. The company markets a variety of species taken in capture fisheries, including shrimp ("langostino"), dorado, corvina, flounder, marlin, tuna, and swordfish--both fresh and frozen product.[245] Unlike many other Ecuadorean companies, the company does not handle cultured harvests. PROMAROSA reports that the availability of raw material during early 1997 has declined as a result of the warming water temperatures. Artisanal fishermen during mid-1997 were delivering only small quantities of dorado and little else. The company is adjusting its marketing strategy to adapt to the changing species mix.[246]

***Photo 37**--PROMAROSA is one of the new companies which has entered export markets for high-quality fresh fish. Alexandra Paez*

Photo 38.--Dorado is one of the principal species that the artisanal fishermen deliver to processing plants, but they also take a variety of other species including sharks. A. Paez

TRANSMARINA: This Manta-based company was established in 1981. Transmarina, a vertical-integrated firm involved in fishing, processing and exporting, is among Ecuador's largest fishing companies. It owns three large 55-m freezer longliners (the *Altar*, *Altar 10*, and the *Altar 11),* and also shares ownership of a fourth similar vessel (the *Altar 7*) with another Ecuadorean company. These vessels were originally Japanese longliners associated with the company. TRANSMARINA purchased and then registered the vessels in Ecuador from 1985-1993. In addition to these four vessels, the company is also associated with six Japanese freezer longliners (appendix A3a). TRANSMARINA targets primarily bigeye tuna, which normally comprises about 65 percent of the catch. Other species are also taken. The company reported that the 1995 catch also included shark (20 percent), swordfish (7 percent), marlin (2 percent), and dorado (2 percent). Although the company purchases some fish from artisanal fishermen, it does not purchase swordfish. Transmarina exclusively markets frozen fish. All the swordfish is exported as frozen H&G and fillets, mainly to the United States (75 percent) and Europe (25 percent). The company exported 39 t of swordfish in early 1996 (through May). Based on this figure, the authors estimate that the company's annual swordfish exports in 1996 probably reached about 90 tons. Although most of the catch is exported, some is marketed domestically as frozen product, mostly dorado, marlin, shark, and small tunas.[247]

USTI: Government officials report that this Santa Elena-based company is associated with various foreign longliners. The authors, however, were not able to contact the company.

VENALUM: This is a joint venture company between Transmarina and a Japanese company. This joint venture owns the vessel *Altar 7*, which is deployed in tuna longline operations. The authors were unable to contact the company.

Others: There are approximately 23 local companies participating in small-scale longlining operations, seventeen of which are members of the ASO-EXPEBLA (appendix C1). The largest companies are CONSEMAR, Gondi, Oro Marisco, Pefresmar, TRANSMARINA which are described above (figure 23). The authors have also described representative examples of several smaller companies (CONSEPAC, Ecuafresco, FRESMAR, Lubar, PEFREEXPORT, and Promarosa) to provide insight into the types of companies involved in the fishery. The remaining companies are mostly small firms with operations similar to those described above.

XII. Markets

The Ecuadorean longline fishery is basically an export-oriented activity. Almost all of the most valuable species (tuna and swordfish) is exported, as well as some species of shark (such as mako and thresher). There exists a strong demand for these species in the major international markets (the United States, the European Union, and Japan), and prices are substantially above those available on the domestic market. Most of the fresh exports are shipped to the United States because of the convenient transportation links and established trading patterns. Developed transportation links are particularly important when marketing fresh product. Important quantities of frozen tuna and billfish are mostly marketed in Japan. The marlin, some of the shark, and non export-grade product are marketed domestically.

A. Domestic

Ecuador's domestic seafood market is limited. The country has a relatively small population. Consumers generally prefer red meat. Many seafood products are too expensive for many Ecuadorean consumers because incomes are generally low. Consumption is especially low in inland population centers due to poor quality product that has in the past been available. The country until recently has lacked a modern distribution infrastructure. In addition to these difficulties, much of the country is mountainous, adding to transportation costs and creating difficulties reaching potential consumers in inland cities. These conditions mean that fresh and frozen fish is eaten mostly in the coastal areas, and that fishery products reaching the "sierra" (the heavily populated mountainous inland areas) is primarily canned or cured product.[248] According to a local observer, the demand for seafood in Ecuadorean coastal cities and towns is relatively high. The large metropolitan area of Guayaquil, Ecuador's largest city, is an especially important market.[249]

Most of Ecuador's finfish catch, with the exception of tuna, was marketed in domestic markets through the 1970s. Ecuadorean companies began developing an export market for fresh product during the mid-1980s. Export markets were developed for the artisanal catch as well as the longline catch.[250] Some of the sharks (except mako and thresher) and billfish are still marketed domestically (photo 39). Some of the other species taken by the longliners, such as amberjack and marlin are also marketed domestically. Fishermen take a variety of species with other gear, such as purse seines and hand lines--in addition to the species taken by the longline fishery. These species are marketed domestically. Butterfish, corvina, grouper, mackerel, mullet, sardines, snappers, and snook are all very popular in Ecuadorean coastal cities and towns.[251]

The domestic market, while limited, is growing. Apparent consumption of fish increased from 11.6 kg per person in 1977 to 13.0 in 1986 (whole weight).[252] The authors do not have more current data on domestic consumption, but believe the rising trend will continue as more pelagic species are utilized for direct consumption, and distributions systems are improved.

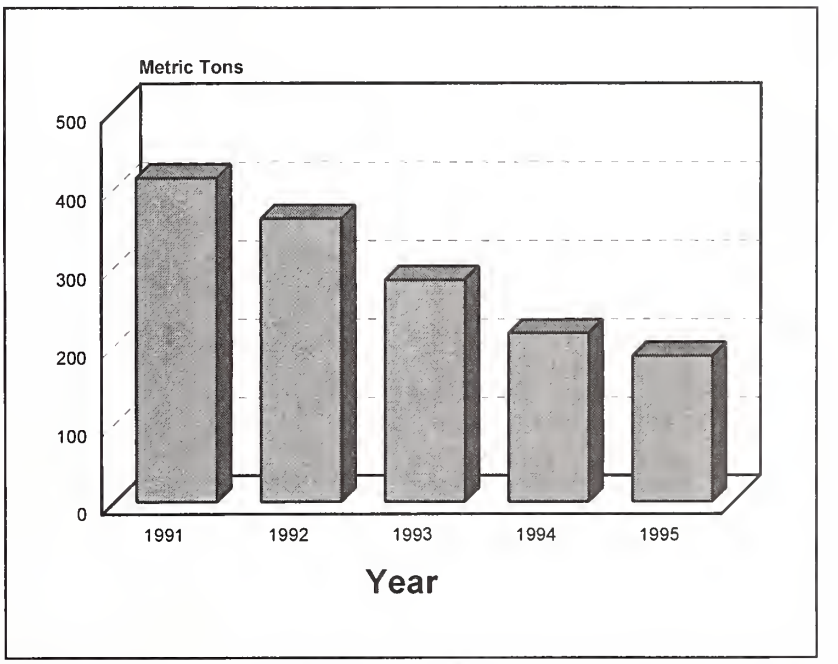

***Figure 25**--Ecuador's overall swordfish exports have declined steadily in the 1990s, but based on shipments to the United States, have since increased sharply during 1996-97.*

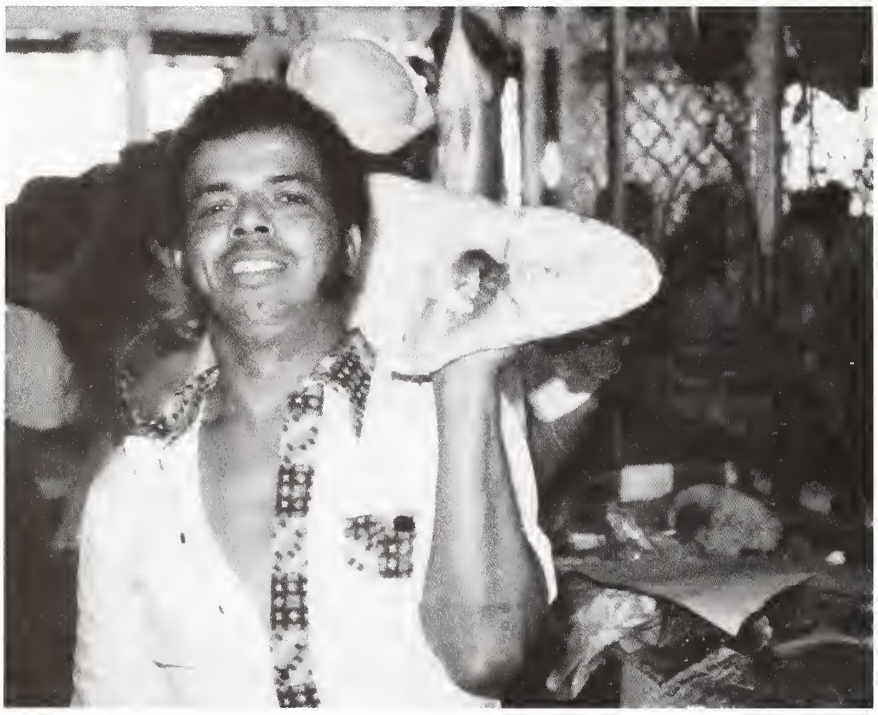

***Photo 39**--Sharks and other large pelagics have traditionally been marketed on the beach or in central markets. Dennis Weidner*

B. Trade

1. Exports

Ecuador began exporting swordfish regularly during the mid-1980s as the longline fishery developed (appendix B2d and figures 15 and 17).[253] Most of the shipments during the late 1980s appear to have been to the United States, but smaller shipments were also made to Japan. Shipments peaked at nearly 500 t in 1987, and then declined sharply in 1988. There were substantial swordfish exports from 1991-92. The reasons for these fluctuations are unclear. The authors have been unable to confirm these shipments with Ecuadorean exporters. The export shipments during the early 1990s declined steadily from the 415 t exported in 1991 to 190 t in 1995 (appendix D1a and figure 25). However, Ecuadorean swordfish exports significantly increased in 1996, apparently due to the expansion of the directed swordfish longline fleet. The principal market continues to be the United States (figure 26).

European Union: Ecuadorean swordfish shipments to the EU during the 1990s have been minimal, usually only 0-2 t (appendices D1a2 and figure 26). Shipments did, however, exceed 80 t in 1994, and totaled nearly 60 t (mostly frozen) in 1995 (appendix D4). The EU reports that most of the product is shipped to Italy and the Netherlands. Unlike several other Latin American countries, no product is marketed in Spain. The authors have been able to find little information on exports to the EU from Ecuadorean companies.[254] A major difference between United States and European markets is the European preference for frozen swordfish loins, instead of the whole fresh H&G pieces importers prefer in the United States.[255] Ecuador does ship substantial quantities of tuna to the European Union, but most of this product is taken by the country's large fleet of small purse seiners. The apparent price of fresh swordfish shipments to the EU increased from about

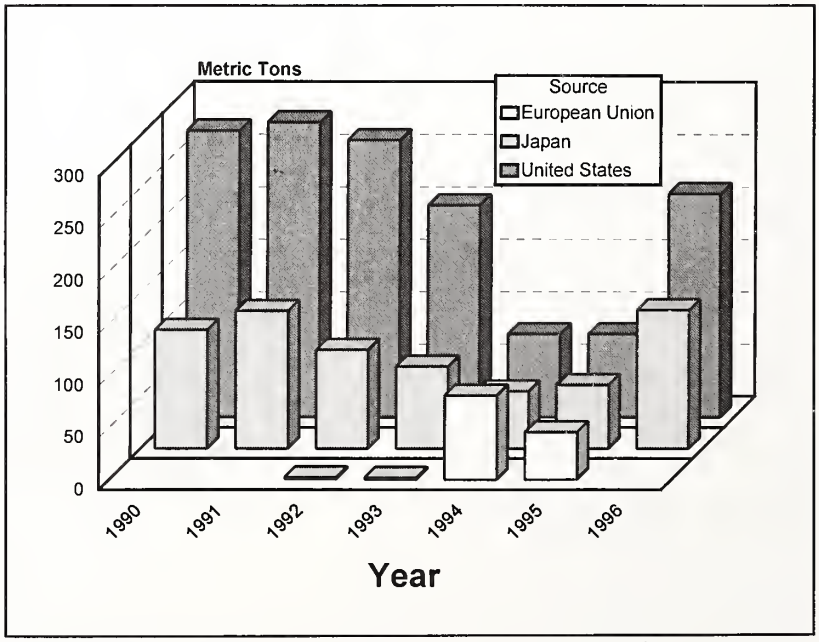

***Figure 26**--The United States is Ecuador's major swordfish market and shipments increased sharply in 1996.*

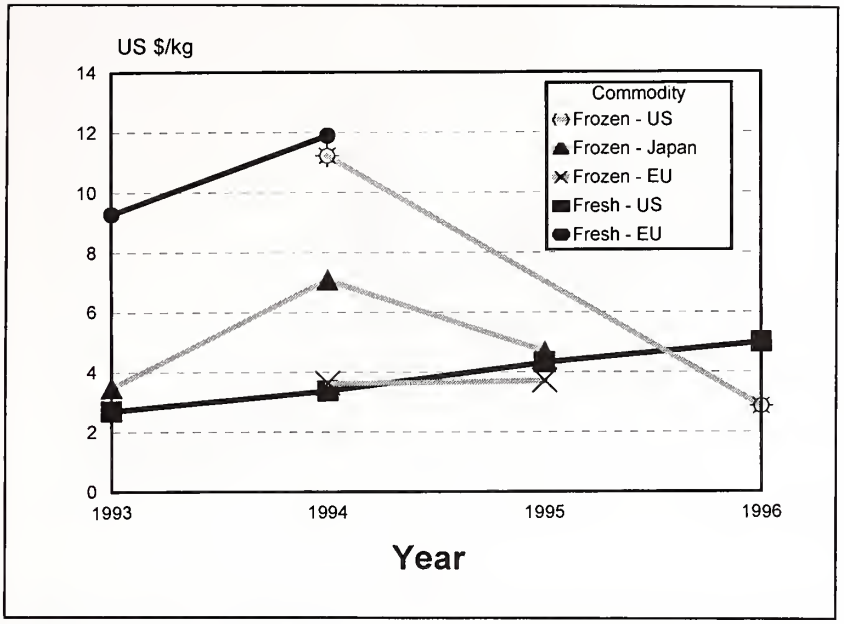

Figure 27.-- Prices for fresh swordfish in the United States, Ecuador's principal market, have increased steadily.

$9.25/kg in 1993 to $12.00/kg in 1994. No fresh product was shipped in 1995. The apparent price of frozen swordfish during 1994-95 was very stable at about $3.75/kg (appendix D1b and figure 27).

Hong Kong: Hong Kong is one of the world's largest markets for shark fin. Press reports indicate that Ecuador is exporting nearly 50 t of shark fins annually.[256]

Japan: Ecuador ships substantial quantities of billfish to Japan. Billfish shipments reached nearly 400 t in 1991. Japan has no separate import code for swordfish, but instead has a basket category combining swordfish with billfish. The authors believe that about one-third of that total could have been swordfish, probably about 130 t, but have no precise data on the actual composition (appendix D3a and figure 28).[257] Shipments declined by more than half, totaling only 160 t of billfish in 1994. Shipments to Japan in 1995 were little changed, about 185 t of billfish (appendix D3a). Ecuadorean billfish shipments to Japan significantly increased in 1996 recovering to 1991 levels of about 400 tons. (See "Fleet".) Most of the swordfish exported to Japan is frozen H&G product (appendix D3b and figure 29). The apparent price of Japanese frozen billfish imports from Ecuador was highly variable during 1993-95, $3.50-$7.00/kg (appendix D1b and figure 27).[258]

United States: The United States is the principal Ecuadorean market for seafood. Most of the shipments are frozen product, primarily shrimp (appendix D2f and figure 30). Shipments of fresh product, primarily tuna, are becoming increasingly important (appendix D2e, D2g, and figure 31). Fresh tuna shipments have increased from less than $3 million in 1990 to nearly $32 million in 1996 (figure 31), reflecting the substantial expansion of the longline fleet. Most of the fresh product is tuna which is largely shipped to the United States (appendices D2a and D2b and figure 32) Swordfish is, however, only a minor portion of Ecuador's fresh shipments (appendix D2g). Swordfish shipments to the United States were reported in the mid-1980s and quickly reached 420 tons. After two poor years (1988-89), shipments leveled off at 200-280 t (1990-93) (appendix B2d and figures 15 and 16). Shipments then declined sharply to only 80 t in 1994 and 1995.[259] The decline was apparently due to catch declines (appendix B2a), but could also reflect increased shipments to the EU

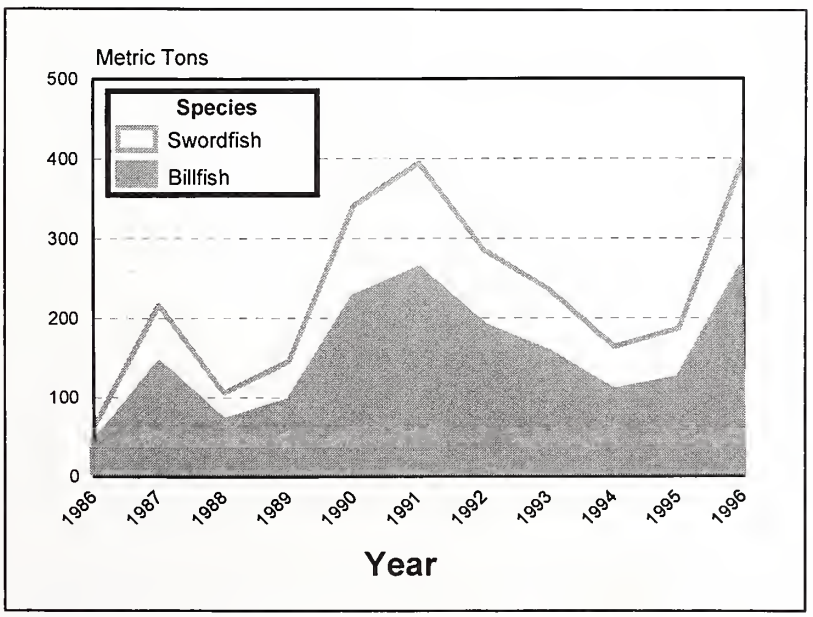

Figure 28.-- Based on the catch composition, most of the Ecuador's shipments to Japan are believed to be billfish rather than swordfish, although the precise quantities are unknown.

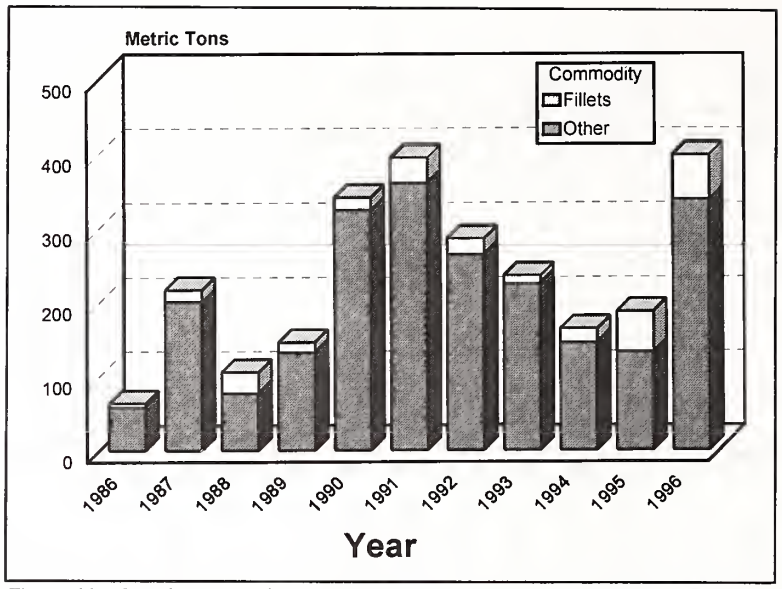

Figure 29.--Ecuador primarily exports billfish and swordfish to Japan as frozen H&G trunks, but also ships small quantities of fillets.

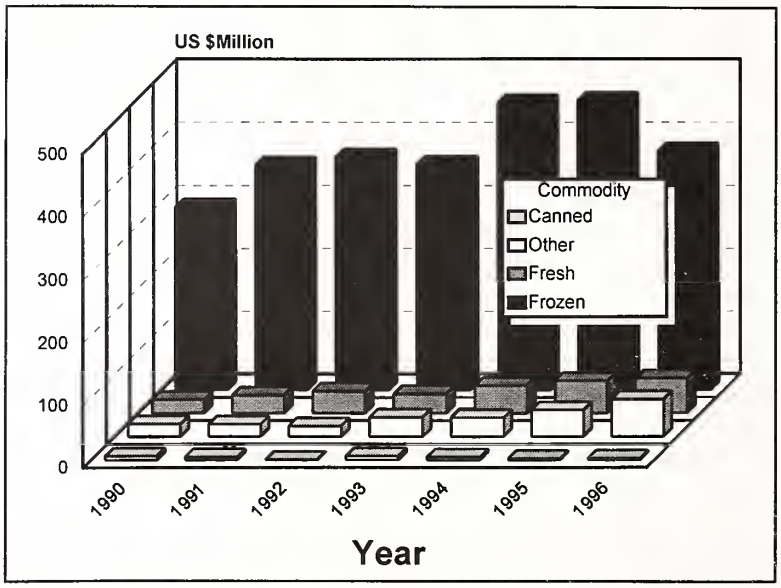

Figure 30.--Most of Ecuador's seafood exports to the United States are frozen product, primarily shrimp.

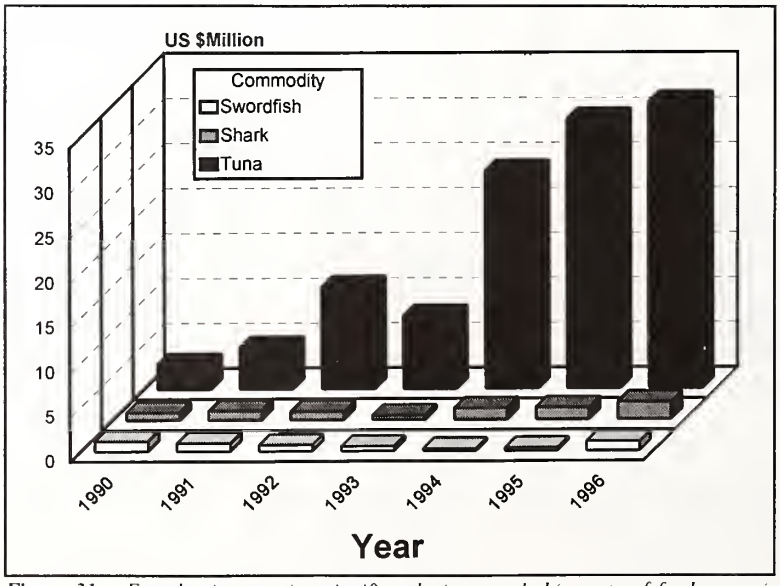

Figure 31.-- Ecuador is reporting significantly increased shipments of fresh oceanic pelagics, mostly tuna, through 1996. Preliminary reports indicate increased swordfish shipments during 1997.

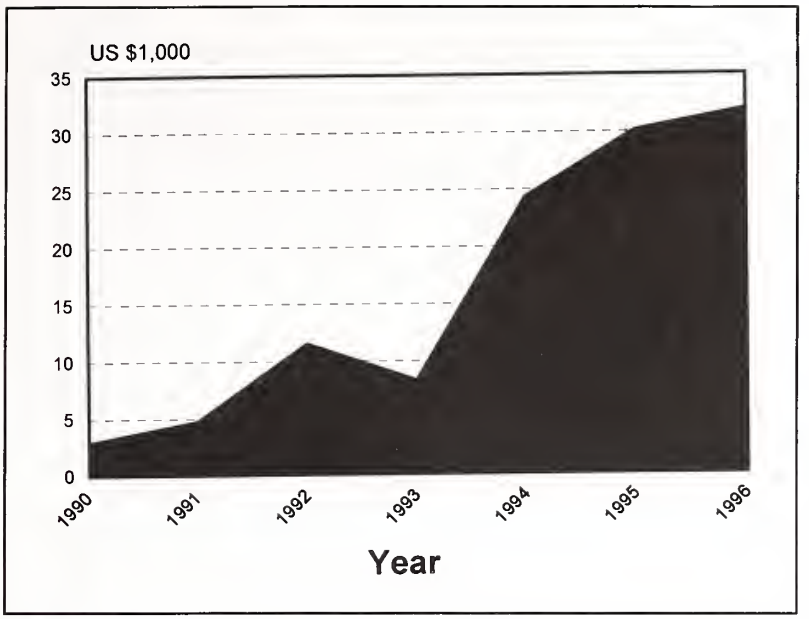

***Figure 32**--Ecuadorean fresh tuna exports to the United States have increased significantly in recent years.*

(appendix D4). Some companies, such as Pesquera Reyes, reported falling catches, although available catch data provides conflicting patterns (appendices B2a, B2b1-1 and figure B2c1-2 and figure 16).[260] Swordfish exports to the United States in 1996 sharply increased to 214 t, but was still below the levels reported in the early 1990s. This appears to reflect 1996 catch increases as a result of the expanding longline fleet. The increase was particularly impressive given the difficulties encountered with Ecuadorean Customs ("Aduana"). Many exporters in 1996 experienced serious problems with Ecuadorean Customs. After the Bucaram Administration took office in 1996, importers have encountered increasing difficulties and rising shipping costs because of escalating bribes demanded by Aduana agents. One Ecuadorean industry leader reports that in late 1996 and early 1997 bribes and delays slowed shipments from Miami by a third.[261] The problems associated with import shipments appear to have also caused significant problems for exporters. Many foreign companies stopped shipping to Ecuador because of the problems with the Ecuadorean Aduana. As a result, airlines increased rates because many air cargo airplanes to Ecuador were arriving empty. Other air cargo companies cancelled flights. One source indicated that the cost of air-freighting from Ecuador increased $0.90 per kg in 1996.[262] Because of the cancelled flights, some Ecuadorean fishery exporters complained that there was not enough space available to export their fresh fish. According to one source, the problem was further exacerbated because flower exporters, who are expanding production, were taking most of the available air cargo space.[263] Industry observers are hopeful that the new government which assumed office in 1997 will rectify the problems. The major U.S. Customs Districts receiving swordfish from Ecuador during the mid 1990s have been Miami, New York, Los Angeles, and Baltimore (appendix D2d and figure 33). The apparent price for exports to the United States has fluctuated significantly since 1985 from a low of $2.66/kg (1992) to a high of $5.00/kg (1996). Since 1992 the price has risen steadily to the record 1996 price (appendix D2c1 and figure 34). Even so, 1996 prices in inflation-adjusted terms are below 1985 prices. Frozen prices have fluctuated much more, but often only small shipments are involved (appendix D2c2 and figure 35). One notable development has been the initiation of swordfish processing. Most of the catch, as in much of Latin America, is exported as H&G trunks, small quantities are being processed as steaks. Production of steaks

***Photo 40**--Several Ecuadorean companies process high-quality fresh product for U.S., European, and Asian markets. Alexandra Paez*

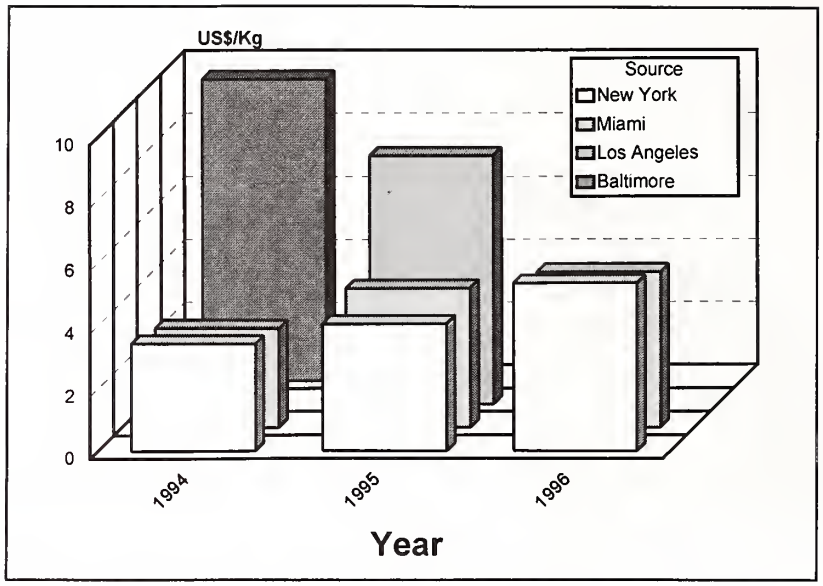

Figure 33. -- In some years the price of Ecuadorean swordfish varies significantly by port of entry, in other years there is little difference.

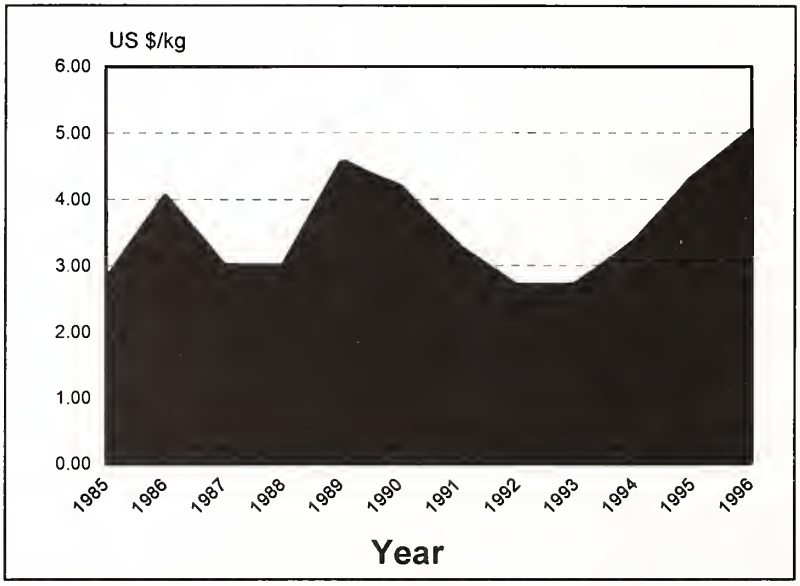

Figure 34.--Prices of Ecuadorean fresh swordfish exports to the United States have been relatively stable, but adjusted for inflation they were lower in 1996 than in 1986.

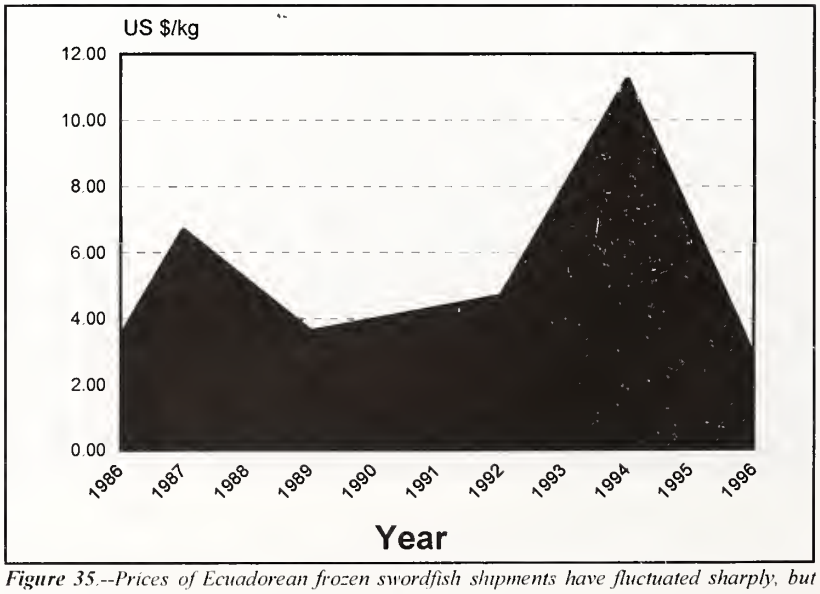

Figure 35.--Prices of Ecuadorean frozen swordfish shipments have fluctuated sharply, but the quantities involved are minimal.

***Photo 41**.--Ecuadorean companies are actively promoting high-quality fresh product in export markets. Alexandra Paez*

through July 1997 totaled 1.7 tons. This is a departure for Ecuadorean companies and comes at a time when Chilean companies are curtailing processing and shipping a greater proportion of their catch as unprocessed trunks. Processing is still, however, a minor activity in Ecuador, constituting only 1 percent of total swordfish shipments to the United States.

Other: Ecuadorean fishing trade associations, such as the Cámara Nacional de Pesquería, have been negotiating trade agreements with MERCOSUR (Argentina, Brazil, Chile, and Paraguay), in order to promote the export of seafood. The large Brazilian market is of particular interest to Ecuadorean seafood exporters. Trade agreements addressing the export of tuna products are among the issues being promoted by the Ecuadorean trade associations.[264] Chile has had considerable success with its seafood on the Brazilian market. The authors, however, know of no Ecuadorean swordfish exports to Brazil, which itself exports much of its catch.[265]

2. Imports

Ecuador does not import swordfish.

XIII. Government Agencies and Policies

A. Agencies

The Ecuadorean fisheries agency is the Subsecretaría de Pesca (SSP) within the Ministerio de Industria, Comercio, Integración, y Pesca. The SSP consists of four line agencies:

Dirección General de Pesca (DGP): The DGM is the principal fishery agency responsible for fisheries management and regulation.

The Instituto Nacional de Pesca (INP): The INP conducts fisheries research and provides quality control services.

The Empresa Pesquera Nacional (EPN): The EPN assists the Ecuadorean fishing industry by promoting the domestic fishery markets.

The Escuela de Pesca de Manta (EPM): The EPM provides fishing and boating education to local fishermen.

B. Fishery laws and regulations

The current Ecuadorean general fisheries law, the Ley de Pesca y Fomento Pesquero, was implemented in 1969. The law is now badly outdated and does not reflect the substantial development and modernization which has taken place since the 1960s. A multitude of amendments and implementing regulations have created a confusing patchwork regulating the industry. Industry officials are highly critical of the current fisheries legislative regime. They are urging the Government to enact a new, more coherent law reflecting the changes which have occurred in the fishing industry during recent years. Juan Carlos Correía, President of the Asociación Ecuatoriana de Armadores de Barcos Pesqueros y Camaroneros, insists that it is urgent for the country to have a coherent fisheries law that would promote and regulate the sector.[266] The SSP was reportedly developing a new Fisheries Law with the assistance of FAO during 1996 to promote development and improve fisheries management.[267]

Ecuador has no fishing regulations specifically regulating swordfish or longline fishing operations. According to a local observer, the reason that there are no regulations directed specifically at the swordfish fishery is that until 1996 there were no directed swordfish operations even in 1997 only a few vessels were involved in directed operations.[268] The INP is currently collecting and analyzing biological and longline catch data to better assess the fishery. This data will serve as a basis for subsequent management and regulations, including regulations on specific species such as swordfish.[269]

Commercial fishermen are highly critical of the driftnets deployed in coastal waters by the artisanal fishermen. One trade association, representing commercial fishermen (ASEARBAPESCA) is trying to convince the Government to restrict the use of driftnets.[270] The DGP, however, has not yet done so.

C. Limits

Ecuador declared a 200-mile Territorial Sea (TS) in 1966.[271] Unlike most other countries which have claimed 12-mile TSs, Ecuador has insisted on a 200-mile TS claim. Ecuador has also established special areas closed to foreign vessels and specified mandatory navigational routes 78 miles north and 145 miles south of the Galápagos Islands.[272] Further, Ecuador claims jurisdiction on the continental shelf beyond 200 miles, along the submarine Carnegie mountain range, measured 100 miles from the 2,500-m depth isobath.[273] The United States protested the claim in 1986. Ecuador has signed marine boundary agreements with neighboring countries: Colombia (1975), Costa Rica (1985), and Peru (1975). Ecuador has not, however, signed the Law of the Sea Convention.

D. Fishing licenses

Foreign fishermen may currently operate in Ecuador's 200-mile TS only if they have an association contract or lease arrangement with an Ecuadorean company. Leased or associated vessels can then operate in Ecuadorean waters and, for the most part, be treated as an Ecuadorean-flag vessel. The leasing arrangements were common in the mid-1970s; but since 1978 most foreign fishermen have operated under association contracts.[274] Most of the foreign vessels leased by Ecuadorean companies are Japanese longliners. Data available for 1992, however, suggest that longliners and purse seiners are also contracted from several other countries.[275]

Licenses: The Government issued licenses to foreign tuna fishermen during the 1960s-70s. The Government in 1991 required interested foreign fishermen to work with Ecuadorean companies.[276]

Leasing arrangements: Leasing arrangements were common during the 1970s, but have generally been replaced with association contracts (appendix A5a1 and figure 20).

Association contracts: Since 1980, association contracts have been the primary mechanism for foreign participation in Ecuadorean fisheries (appendix A5a and figure 20). The number of contracts peaked at 32 in 1988, but there were still 24 in 1992 and 18 in 1996 (appendix A5a).[277] Most of these contracts have involved tuna longliners and seiners, but in the early 1990s quite a number were for squid jigging. The Government prohibited squid fishing in October 1992, causing 12 of the foreign vessels to withdraw.[278] Association contracts can only be arranged for vessels of 600 GRT or less. Foreign vessels with association contracts receive the same treatment under Ecuadorean law as national vessels as long as the contract is in force.[279] This means that the owners do not have to purchase Ecuadorean fishing licenses. The associated vessels cannot, however, fish within 40 miles (64 km) of the coast, either along the mainland or off the Galápagos Islands. Foreign fishing vessels without such association contracts are prohibited from entering Ecuador's 200-mile TS, except for repairs at an Ecuadorean shipyard or in the case of emergencies.[280]

Association agreements have been encouraged by the Ecuadorean Government since the mid-1970s in an effort to promote the development of the country's fishing industry. Associated foreign vessels can operate as domestic vessels and do not need to obtain the license that foreign vessels normally need. The DGP, as the Ecuadorean fishing fleet develops and becomes more efficient, plans to reduce the number of foreign vessels operating off Ecuador under association contracts. Current plans involve ending access for foreign vessels by 1999.[281] The Government has established basic requirements for these association agreements:

Crew: The crews have to be composed of at least 75 percent Ecuadorean nationals.

Technology: The vessels have to be equipped with modern gear and equipment to facilitate the acquisition of such technology by the Ecuadorean fishermen.

Domestic partner: The Ecuadorean processing/export companies must be classified as a class "Special" or "A." These categories relate to the volume of product processed and exported annually and to the ownership of vessels. Small processing companies that do not own any type of fishing vessels are not permitted to sign association agreements with foreign vessels.

Observers: There must be a local observer aboard the vessel to collect catch data.

Fees: The foreign vessel owner must pay an annual fee of $20,000 to the Ecuadorean Government. These fees collected are utilized by the Ecuadorean Government to finance fisheries research. (See "Research".)

Fishing licenses: The associated vessels do not have to purchase any fishing licenses to catch swordfish or tuna and are treated as domestic vessels under Ecuadorean law.[282]

Landings: The by-catch includes amberjacks, blue and striped marlin, and several species of shark, among others. The target species are tuna and to a lesser extent swordfish and mako shark.[283] Virtually all of the high-quality catch of these species is exported.

Financial arrangements: The authors do not have details on the financial arrangements involved. Local observers, however, reported that the foreign vessels are required to sell all the catch to the associated Ecuadorean company.[284] The by-catch caught by the foreign vessel, or at least 15 percent of the total catch, must be sold to the associated Ecuadorean company at prevalent market prices. Japanese officials indicate, however, that Ecuadorean regulations require that the shark catch be frozen and landed at Ecuadorean ports where it is donated for popular consumption.[285]

XIV. Research

Several organizations conduct fisheries research in Ecuador. Most of this research is focused on the important commercial fisheries, such as the shrimp trawl fishery. Research directed towards the still small longline fishery has been limited. However, the authors believe that the growing importance of the artisanal and semi-commercial longline fishing fleet in terms of catch and export revenues will result in increased future research. The following are the main agencies and organizations conducting fishery research in Ecuador:

Inter-American Tropical Tuna Commission (IATTC): IATTC is a multilateral organization focusing on tuna management. The organization also conducts research studies which focus mainly on the tuna purse-seine fishery. IATTC operates a statistical office in Manta. IATTC sponsors some limited research on other oceanic pelagics such as swordfish. See "International".)

Instituto Nacional de Pesca (INP): Fishery research in Ecuador is primarily conducted by the Guayaquil-based INP, which is a dependency of the SSP. The INP conducts research on fishery resources, physical and chemical oceanography, marine pollution, biology of marine and freshwater species, and processing of fish products.[286] The INP has been assessing catch data from the longline fishery since 1992. The observer program for the associated foreign longline vessels has collected extensive data on the oceanic pelagics like swordfish.[287] Other than recording the foreign longliner's catch and monitoring the artisanal catch, at the country's eight major landing sites, the INP has not conducted any specific study related to swordfish.[288] The INP partially funds all its research efforts, such as the maintenance and use of its research vessels through foreign licensing/leasing/association fees. The INP has two principal research vessels, the *Tohalli* (a 33-m vessel utilized to study oceanographic variables and pelagic resources) and the *Proteo* (an 8-m boat utilized mainly to study coastal fishery resources). In addition to these vessels the INP has several smaller boats used to conduct research studies on coastal fishery resources.[289] The INP is also responsible for inspecting seafood exports to ensure product quality. Ecuadorean companies must obtain an INP sanitary certificate to export fishery products.[290]

Programa de Cooperación Técnica para la Pesca Unión Europea (VECEP): This multilateral development program was established in 1993 by the European Economic Community (now the European Union) and Venezuela, Colombia, Ecuador, and Perú. VECEP's objectives are to promote artisanal fisheries, evaluate selected fishery resources, and transfer fishing industry data and technology to the local fishermen through training programs. The program provides funds and technical assistance to the INP's research programs. VECEP research and training programs promote the development of different industry sectors, such as the small pelagic and demersal artisanal sectors, as well as the commercial trawl fishery.[291] VECEP in 1996 provided technical and financial assistance to the INP for the Evaluation of Fishery Resources Project. This project's main objectives are to: 1) estimate the biomass of several small pelagic and coastal demersal species; 2) collect data on artisanal landings, and 3) evaluate coastal oceanographic conditions.[292]

PRAPESCA: The German Government sponsors this fisheries assistance program which seeks to develop the country's artisanal/semi-commercial fisheries through technology transfer and research. See "International relations" below.

Others: There are other organizations conducting fisheries research, such as the Universidad Eloy Alfaro de Manta and the Universidad Técnica de Manabí. However, the authors know of no research on tuna, swordfish, and related species conducted by these institutes.

XV. By-catch

Little information is available on the by-catch taken in tuna, swordfish, and related fisheries for oceanic pelagics. The small domestic swordfish effort suggests that the by-catch is limited, but the larger domestic longline fisheries for tuna, dorado, and other species is more important with a larger potential by-catch. The only available information is limited anecdotal accounts (appendix A3b). Extensive foreign commercial longlining also suggests a significant by-catch. The authors know of no study on the Ecuadorean or foreign longline by-catch in the ETP. Some work has been done on foreign longliners in the western Pacific which provides some guidelines for assessing possible ETP by-catches.

Target species: Ecuadorean longline fishermen target primarily bigeye tuna (*Thunnus obesus*) rather than swordfish. There has also been considerable effort deployed for dorado (*Coryphaena hippurus*). Artisanal longliners report that tuna is normally about 60 percent of their catch (appendix B3b).[293] Until recently there were no directed swordfish operations, but small quantities were taken as a by-catch in the tuna fishery. The longliners that have begun targeting swordfish west of the Galápagos are continuing to take substantial bigeye catches, as much as 15 percent of their catch. Several other species are also caught with the longlines (appendix B3b).[294]

Sharks: Ecuadorean companies began considering a shark fishery in the 1980s. Some traditional artisanal fishermen took sharks with hand lines and other gear, in some cases from small boats (photo 42).[295] Artisanal tuna longline fishermen report sharks constitute about 20 percent of their catch (appendix B3b).[296] The longline fishermen initiating directed swordfish operations during 1996-97, reported higher shark by-catches of up to 40 percent.[297] U.S. imports of fresh shark from Ecuador increased sharply in 1995 and 1996 (figure 36). The catch includes several species of shark, including blacktip (*Carcharhinus limbatus*), blue (*Prionace glauca*), mako (*Isurus oxyrinchus*) and thresher (*Alopias vulpinus*). The Government regulates the exports of shark fins.[298] Illegal foreign fishing targeting sharks for the fins, especially off the Galápagos, has been sharply criticized in the Ecuadorean media.[299]

Billfish: The Ecuadorean tuna longline fishermen report incidental catches of Indo-Pacific blue marlin (*Makaira mazara*), striped marlin (*Tetrapturus audax*), and sailfish (*Istiophorus albicans*). Foreign fishermen have reported varying distribution of billfish off Ecuador. The foreign longliners reported during the early 1960s that striped marlin was the major species,

***Photo 42**--Some artisanal fishermen operating on the open ocean from dugout canoes reported shark catches, a dangerous occupation. Dennis Weidner*

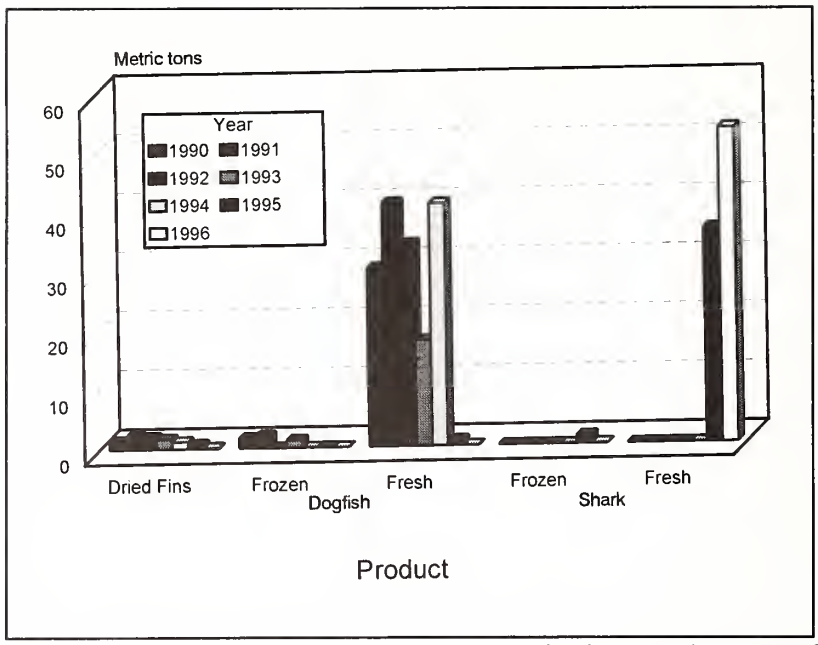

Figure 36--Ecuadorean companies have begun exporting sharply increased quantities of fresh shark to the United States in 1995 and 1996.

but during the mid-1970s, swordfish predominated. Foreign catches have been more mixed during the early 1990s with notable catches of swordfish, striped and blue marlin, and small catches of black marlin.[300]

Swordfish: Ecuadorean tuna longline fishermen have reported only a small swordfish by-catch in coastal waters (appendix B3b). Government officials estimate the swordfish by-catch of the longline tuna fishery during the early 1990s at only 1-3 percent.[301] Several of the companies involved in the fishery report slightly higher estimates of about 5 percent (appendix B3b). (See "Companies".) This has begun to change in the mid-1990s as a few domestic longline fishermen have begun to conduct directed swordfish fisheries in operations further off the coast. The fishermen that have initiated directed swordfish operations west of the Galápagos during 1996-97 are reporting swordfish catches of up to 25 percent.[302]

Other finfish: The tuna longline fishermen report that most of their catch is bigeye tuna and sharks. About 15 percent of the catch is various other species, primarily billfish and swordfish (appendix B3b). A few other species are also of some importance. The fishermen report an incidental catch of other finfish such as wahoo (*Acanthocybium solandri*) and yellowfin tuna (*Thunnus albacares*). Other species caught in lesser quantities with surface longlines are listed in appendix E.

Sea turtles: Several sea turtles, including Pacific green, *(Chelonia mydas agassizi)*, olive Ridley, (*Lepidochelys olivacea)*, hawksbill, (*Eretmochelys imbricata)*, and leatherback (*Dermochelys coriacea*) are present in Ecuadorean waters. The most common species (olive Ridleys) nest in Mexico and Central America and migrate as far south as Ecuador and Peru in search of food.[303] Green turtles actually nest along the Ecuadorean coast and on the Galápagos Islands. The green turtles extensively nest on the Galápagos (Baltra, Bartolomé, Floreana, Isabela, Santa Cruz, and Santiago Islands) and along islands off the mainland, such as Isla de Plata and Santa Marianita (Manabí).[304] Notably some of these areas are near Manta, Ecuador's principal fishing port. Also, modest numbers of hawksbill and leatherback turtles nest on the beaches in and around Machalilla National Park (Manabí). Little information is available, however, concerning the populations of marine turtles off Ecuador.[305] Artisanal fishermen have conducted a directed turtle fishery as well as taking them incidentally (photo 43). The government closed the directed offshore fishery for olive ridleys during the mid-1980s. FAO confirms that the commercial harvest, which had been

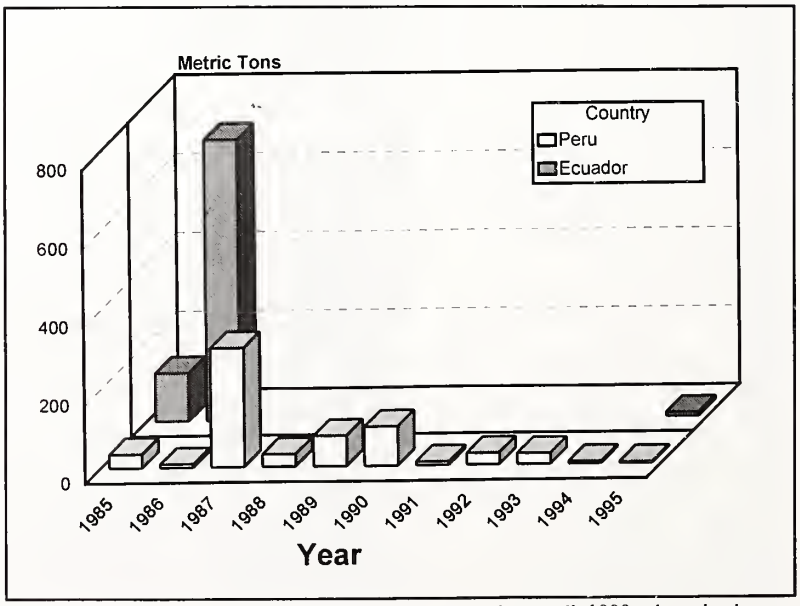

Figure 37.-- Ecuador reported substantial turtle catches until 1990 when the harvest dropped sharply because of increased enforcement of regulations.

***Photo 43**--In addition to a directed fishery, artisanal fishermen during the 1980s routinely reported incidental sea turtle catches in coastal waters. Dennis Weidner*

significant, ended in 1986 (appendix B3a and figure 37). Press reports indicate that some turtle processing plants were active in Manta during 1987.[306] The Government permanently ended the directed turtle fishery in 1990, prohibiting the catch as well as domestic and export marketing.[307] Longline fishermen targeting bigeye and swordfish report minimal by-catches of sea turtles. According to a local observer, incidental catches of sea turtles and marine mammals by commercial fishermen are very rare.[308] Other observers report that such interactions do occur. The authors have observed artisanal fishermen landing turtles (photo 43). There also appears to be at least some turtle interactions with commercial fishermen. Ecuadorean authorities have seized turtle skins aboard Japanese longliners.[309] The authors, however, know of no detailed assessment of the by-catch involved. One study suggests that foreign longline fishermen in the western Pacific seldom or rarely take turtles and do not retain them.[310] U.S. Hawaii-based longline fishermen report more substantial turtle interactions with hook rates in 1 year amounting to 0.12-1.15 turtles per 100,000 hooks set.[311] Possible turtle mortalities from longline and driftnet fisheries are of concern because of the depleted state of some species. Biologists are especially concerned with the precipitous decline in leatherback nestings. Mexican officials report that leatherback nestings have reached critically low levels.[312] Anecdotal accounts and tag returns have noted incidental catches of leatherbacks from Mexican and Costa Rican beaches in the southeastern Pacific as far south as Chile. Recent satellite tagging data shows that after nesting on Mexican beaches, leatherbacks move due south through oceanic areas off Central America to the Galápagos. The turtles then appear to be moving on to Peru and Chile, although only preliminary data is available (Peru, figure 30).[313] The current Ecuadorean tuna/swordfish fishery almost certainly takes some leatherbacks. The expansion west to the Galápagos suggests that incidental catches may be an increasing problem, although the depletion of leatherback populations may mean that actual number of turtles from the depleted stock are not increasing. Interactions may also occur with other Ecuadorean

fishermen. Artisanal fishermen operating in coastal waters, for example, are expanding the use of driftnets. The composition of the turtles species taken by the commercial and artisanal fishermen is not available.

Pinnipeds: The authors have no information on longline interactions with pinnipeds off Ecuador. The fishermen generally report that such interactions are rare or non-existent, but the authors know of no scientific study confirming this. Ecuadorean biologists believe that interactions do take place because of the remains of sea lions observed washed up on the beach.[314] Pinnipeds are relatively rare along the mainland coast. Sea lions (*Otaria flavescens/byronia*) are occasionally noted along the mainland.[315] A populations of fur seals (*Arctocephalus galapagoensis*) occurs on the Galápagos.[316] There is also a population of Galápagos sea lions (*Zalphus californianus wollebaeki*), a different subpopulation than California sea lions.[317] As the commercial longline fishery shifts further westward toward the Galápagos, the possibilities for interactions increase. Based on an assessment of western Pacific fisheries, however, interactions may be rare.[318] U.S. Hawaii-based longliners do not report pinniped mortalities, but local populations are small.[319]

Cetaceans: The authors have no information on cetacean interactions off Ecuador with longline fishermen. There are occasional reports of artisanal longline fishermen using dolphins as bait.[320] The fishermen, however, were generally reluctant to discuss the issue because of the problems several countries have encountered marketing tuna in the United States as a result of U.S. dolphin protection programs. Whales are protected under Ecuadorean law. Catches are prohibited and a sanctuary has been created around the Galápagos Islands.[321] The most common large cetaceans off Ecuador are sperm whales (*Physter catodon*).[322] The presence of squid, a preferred prey item for swordfish, also draws sperm whales.[323] Sei (*Balaenoptera borealis* and fin (*B. physalus*) whales have also been observed.[324] Other species, especially killer whales, are regularly sighted around the Galápagos. The presence of killer whales suggests that the potential for interactions with the longline fishermen exists.[325] It appears that the primary problem with cetaceans is that the animals learn to feed on the longline by-catch. This is a serious problem reported elsewhere in Latin America.[326] Some incidental hookings or tangles are possible with the animals playing or feeding on the bait or hooked catch. Such interactions are probably limited as given the cost to the fishermen, they will usually avoid areas in which cetaceans, especially killer whales and false killer whales, are found.[327] U.S. Hawaii-based longline fishermen report substantial cetacean interactions, but few mortalities.[328]

Some Ecuadorean fishermen deploy driftnets. The authors have little information on the extent of the fishery and the by-catch involved. This appears to be primarily an artisanal fishery targeting coastal species. Catches of oceanic pelagics appears to be limited. Ecuadorean commercial shrimp fishermen have complained to the Government about the use of driftnets by the artisanal fishermen. According to ASEARBAPESCA, the driftnets are taking increasing amounts of shrimp and, in some cases, these nets have caught marine mammals, even sperm whales.[329]

XVI. International

A. International relations

Ecuador has few bilateral government-to-government contacts with other countries concerning the longline fishery. Most of the contacts have been with private companies and trade groups rather than with the foreign governments. The primary interest of the foreign fishermen has been to obtain access to Ecuadorean tuna grounds. There appears to have been limited interest in swordfish because the foreign, mostly Japanese fishermen, were mostly concerned with bigeye tuna. There have been some contacts with foreign governments connected with aid programs. Various countries and multilateral agencies have supported development programs, including fisheries for oceanic pelagics.

1. Multilateral

The primary multilateral organization concerned with oceanic pelagics in the ETP is the IATTC. While IATTC has focused primarily on tunas, it is expanding work on swordfish and other billfish.

EPOFTA: The United States attempted to negotiate an interim tuna management regime in the ETP during the early 1980s. Several Central American countries, especially Costa Rica and Panama, participated in the discussions. Ecuador did not participate. The agreement covered tunas and focused on the purse-seine fishery. While an agreement was signed in 1983, the Eastern Pacific Ocean Tuna Fishing Agreement (EPOFTA), an insufficient number of ratifications were obtained to bring it into force.[330]

IATTC: Ecuador was a brief participant in the IATTC. The Commission was founded in 1950. Ecuador joined in 1961, but withdrew in 1968 because Ecuadorean officials concluded that the IATTC limited their fisheries management authority. The Ecuadorean Government permits the IATTC to operate a statistical office in Manta. IATTC focuses on tuna purse-seine fisheries, especially the yellowfin fishery, but in recent years efforts to prevent dolphin mortalities in that fishery have assumed considerable importance. IATTC also sponsors more limited research on other oceanic pelagics such as swordfish, other billfish, and sharks.

LATO: This organization was created in 1995 as a result of a long series of negotiations sponsored by OLDEPESCA. Ecuador was an active participant in these negotiations. The agency is not yet active and if and when it begins work, it will almost certainly focus on tuna. Swordfish would likely be a low priority, if addressed at all.

OLDEPESCA: The Organización Latinoamericana de Desarrollo Pesquero (OLDEPESCA) has attempted to coordinate regional approaches to developing the tuna resource. OLDEPESCA has also focused primarily on the ETP tuna purse-seine fishery. The authors do not know of any OLDEPESCA projects concerning longlining off South America, but OLDEPESCA does coordinate a Central American fisheries development project financed by the EU which has attempted to introduce modern longlining methods.[331]

European Union: The Programa de Cooperación Técnica Para la Pesca Union Europea (VECEP) is a technical cooperation program financed by the EU to modernize fishing industries from South American countries (Venezuela, Colombia, Ecuador, and Peru). VECEP activities have included efforts to help modernize the Ecuadorean artisanal and semi-commercial fishery, including the transfer of modern longline gear and methods. VECEP also promotes research. (See "Research".)

2. Bilateral

The authors know of no bilateral government-to-government contacts specifically addressing the swordfish fishery. Ecuador has licensed foreign tuna longliners (mostly Japanese) or arranged leasing/association contracts, but these arrangements are made by a Japanese tuna cooperative industry group (Nikkatsuren) and not through the Japanese Government. Other arrangements with foreign fishermen have also been made with individual companies and not the foreign government. One foreign government (Germany) does sponsor a bilateral fisheries assistance program.

Canada: Canadian fishermen operated five longliners under association agreements in 1996. (See "Joint Ventures.")

Costa Rica: Costa Rican fishermen during the 1990s developed a small longline fleet, primarily targeting tunas.[332] Unconfirmed reports in 1996 indicate that the expanding Costa Rican fleet is taking fish, including swordfish, in international waters off the Galápagos.[333] Costa Rica reported sharply increased swordfish exports in 1996.

European Union: Ecuador has no significant international exchanges with the European Union (EU) on swordfish. There have been, however, discussions on other related seafood issues. The EU assists Ecuador and other Andean countries with its anti-drug program, offering special reduced tariff rates for some seafood products--including canned and

frozen tuna. These incentives, however, are subject to some restrictions--such as the origin of the tuna being exported. To qualify, the product being exported has to be caught by the country's domestic fishing fleet or within the country's jurisdictional waters. EU inspections of Ecuadorean tuna exports have revealed that the origin of some of the tuna was not in compliance with those regulations.[334] Most of this tuna, however, is taken by purse seiners and not the country's longliners which report very small swordfish by-catches.[335] In addition to direct contacts with the EU, Ecuador also has exchanges with two EU member countries (Germany and Spain).

Germany: The German Government sponsors a fisheries assistance program, PRAPESCA, to transfer technology to the artisanal/semi-commercial fishery which includes modern longlining technology. This program has focused its efforts in Esmeraldas Province along the northern coast.

Japan: Most of the foreign longline fishermen operating off Ecuador have been Japanese. The arrangements have been made by an industry trade group, the Nikkatsuren. (See "Joint Ventures.") Japanese longliners have targeted tunas, but report a substantial swordfish by-catch. The Japanese operate within the 200-mile coastal zone, outside of a 40-mile coastal strip. They report their best catches around the Galápagos (figure 8). The principal fishery, however is conducted to the south and west of Ecuador and off southern Peru.[336] The Ecuadorean media has been particularly critical of reported illegal Japanese fishing.[337] Some seizures of Japanese vessels and other legal sanctions against Japanese fishermen have been reported. Ecuadorean authorities in 1985 seized turtle skins aboard a Japanese fishing vessel in Manta.[338] The Navy in 1989 seized the *Tenyu Maru 38* which was working with LUBAR as a result of charges concerning shark finning.[339] Japanese officials denied the charges.[340] Another press report indicated that the Navy seized the Japanese longliner *Shoei Maru 28* off Isabela Island (the Galápagos) with 20 t of shark fins during September 1944. Local artisanal fishermen were observed in the area and authorities believe the artisanal fishermen operated in protected Galápagos waters and delivered the catch to the Japanese and other foreign fishing vessels.[341]

Korea: Korean fishing activity off Ecuador has varied in recent years. The Koreans reported very good longline catches in 1988, but no fishing in 1989-90. Limited catches were reported in 1991-92.[342] Korean fishermen operated five longliners under association agreements in 1996. (See "Joint Ventures.")

Spain: Several Spanish fishermen have negotiated commercial arrangements with Ecuadorean companies. Some of these operations deal with oceanic pelagics (especially tuna) but focus on the purse-seine fishery supplying local canneries. Several Spanish longline fishermen (mostly individual vessel owners) are known to operate in the Pacific, primarily for swordfish. The authors believe that their operations, however, are normally conducted south of Ecuadorean waters. One observer, however, reports occasional Spanish longlining as far north as Ecuador.[343] The Spanish fishermen transship their catch through Peruvian ports, but fish as far south as central Chile.[344] Little information is available on Spanish Pacific longlining as the Spanish are not reporting the catch to FAO. The authors know of no arrangements with Ecuadorean companies or transshipments through Ecuadorean ports.

United States: Several U.S. fishermen have negotiated commercial arrangements with Ecuadorean companies. However, as with Spanish fishermen, the arrangements made by U.S. fishermen have concentrated on the tuna purse-seine fishery. U.S. Pacific swordfish operations are primarily conducted north of the Hawaiian Islands (photo 44). Some limited effort has been reported off Chile.[345] The authors, however, know of no U.S. effort off Ecuador.

Others: Several other foreign fishermen have negotiated commercial arrangements with Ecuadorean companies. Some of these operations deal with oceanic pelagics (especially

***Photo 44**.--The U.S. Pacific swordfish longline fleet operates primarily out of Honolulu in the north Pacific and does not fish along the western coast of South America. Dennis Weidner*

tuna) but focus on the purse-seine fishery supplying local canneries. (See "Joint Ventures.")

B. Joint ventures

Ecuador's domestic longline fishery is primarily conducted by wholly-owned Ecuadorean companies. Foreign companies played an important role in the country's tuna purse-seine fishery, but they have not been equity partners in the longline fishery. The authors know of only one joint/venture equity arrangement involving longlining, Prime North Ecuador which has a New Zealand partner. There is, however, some foreign involvement as Ecuadorean companies (such as CONSEMAR, LUBAR, TRANSMARINA, and USTI) have entered into special agreements or associations ("contratos de asociación") with foreign companies. These arrangements are leasing/association contracts and not equity ventures. These arrangements have been reported since 1975, peaking at 32 contracts in 1988 (appendix A5a). No current data is available, but one local observer estimates that there were about 10 Asian vessels operating in association with local fishing companies in 1996.[346] Some of these vessels were subsequently purchased and reflagged in Ecuador. Press reports suggest that a number of vessels are involved. One Japanese press report in 1992 estimated that Asian countries (Japan, Korea, and Taiwan) flagged nine fishing vessels in Ecuador.[347] Other reports confirm that several Asian longliners have been registered in Ecuador (appendix A3d). Information on the ownership and operations of these vessels, however, is very limited and it primarily describes association contracts. One estimate suggests few Asian longliners have actually been reflagged in Ecuador (appendix A4c). Some problems have been encountered by the vessels that were reflagged (photo 22).

Countries whose fishermen have been active off Ecuador include:

Canada: About five 25-m Canadian longliners operated in association with an Ecuadorean company during 1996. Unconfirmed reports suggested that these vessels were operating in association with LUBAR. (See "Companies".) A Canadian company is also doing some test fishing out of neighboring Colombia.

Japan: Japanese longliners have been regularly operating under association contracts since the mid-1970s. Approximately six Japanese longliners were operating under association contracts in 1982. By 1989 the number of longliners operating under these contracts had risen to 10-20 vessels.[348] Reports vary as to the number of large Japanese freezer longliners fishing during 1996. However, based on various anecdotal reports, the authors estimate the number at 15-25 vessels. Several Japanese longliners have been acquired by Ecuadorean companies after association relationships. For example, TRANSMARINA, one of Ecuador's major fishing companies has acquired and registered seven Japanese vessels under the Ecuadorean flag. (See "Companies".) TRANSMARINA is currently associated with a Japanese company through the VENALUM joint venture. The joint venture company, which is involved in tuna longlining operations, owns the *Altar N° 7*.

Korea: Korean vessel owners also established association agreements with Ecuadorean companies since the early 1980s. Six Korean longliners were transferred to the Ecuadorean flag in 1982. About 20 percent of their catch was marketed in the domestic market, while the rest was exported by the associated Ecuadorean company.[349] Operations with some Koreans vessels have failed and they have been abandoned at Manta (photo 22). About five large Korean 55-m freezer longliners operating in association with a local company during 1996.[350]

New Zealand: The New Zealand company Prime North Corporation established a joint-venture company (Prime North Ecuador) with PESYMAR, an Ecuadorean company, in 1996. PESYMAR will export all the catch caught by the associated vessel *Kona Wind* through the joint venture. The vessel is owned by the Prime North Corporation. The joint-venture company (Prime North Ecuador) operates the vessel, primarily targeting bigeye tuna. According to a company spokesman, the joint venture is attempting to market high quality bigeye tuna in the Japanese market.[351] The New Zealand company is now considering operations out of Colombia.

Other: Ecuadorean fishing companies have formal association relationships with other companies in countries such as Spain and the United States. However, these agreements involve primarily companies operating tuna purse seiners, in which virtually no swordfish is taken.[352]

XVII. Future trends

Ecuador is one of the few South American countries to develop a tuna/swordfish longline fishery. The Ecuadoreans have contracted foreign companies to operate large modern longliners producing frozen product. Domestic fishermen in Ecuador are unique in that in addition to small coastal longliners they have organized the fishery so that a substantial number of artisanal fishermen deploy fast fiberglass can deliver a high-quality product and thus participate in lucrative, export oriented fishery. Artisanal fishermen in "lanchas" often work in association with larger, but still relatively, small motherships. A few companies are also deploying commercial longliners capable of fishing beyond the Galápagos.

Ecuadorean fishermen have primarily focused on tuna, but have reported some directed swordfish operations since 1996. Many small new companies are pursuing operations delivering high-quality fresh product to export markets. The companies are expanding the fleet and extending the range of operations which now reaches grounds to the west of the Galápagos. Companies began to report increased swordfish exports in mid-1996 and have continued shipments at above average levels through mid-1997. The industry appears to be gradually growing. Fishermen will report an important catch increase in 1997 and should be able to continue doing so for the rest of the decade--although the impact of the 1997 El Niño is yet to be determined.

Some observers are concerned about the impact of expanding commercial and artisanal fishing effort out of and around the Galápagos Islands and their irreplaceable natural fauna. The impact of the fishery on the Galápagos ecosystem is of special concern. Any major expansion of the fishery west could have significant harmful affects on the Islands. Such an expansion could also adversely affect a variety of species taken incidentally, but the extent of that impact is yet to be determined.

The willingness of Ecuadorean officials to cooperate in any international management effort is unknown. Ecuadorean officials except for a few years have not participated in efforts to manage ETP tuna through the IATTC. Their participation in the OLDEPESCA regional tuna discussions leading to the EPTO suggest a reluctance to cooperate even with other Latin American coastal countries. Ecuador has not participated in the international swordfish symposia, but until recently the domestic catch has been quite limited.

Note: The layout of this chapter was designed and formatted by Nelsenia Wood, a senior at Parkdale High School in Riverdale, Maryland. Ms. Wood worked with the National Marine Fisheries Service during the summer of 1997 as part of District of Columbia Metropolitan Consortium for Minorities in Engineering (METCON). After finishing high school she plans to pursue a university degree in aerospace engineering or marine biology.

SOURCES

Abbott, Allison. "Fishermen fight rangers in conservation battle for Galápagos," *Time* April 17, 1997, p. 638.

Anonymous source, personal communications, May 30, 1996.

Anotonetti, Emira. Instituto del Mar de Peru, personal communications, May 19, 1997.

Aquarius, July-December, 1993.

Arriaga M., Luis. "Actividad ballenera en el Pacíico suroriental," *Revista de Comision Permenente en el Pacífico Suroriental*, Vol. 5, 1976

_____. Biologist, personal comunications, VECEP, April 7, 1997.

Arocha Freddy. Universidad de Oriente (Venezuela), personal communications, July 7, 1997.

Asociación de Atuneros de Ecuador (ATUNEC). Informational brochure, undated, Received on February 20, 1997.

Bailey, Kevin. Peter G. Williams, and David Itano. "By-catch and discards in Western Pacific tuna fisheries: A review of SPC data holdings and literature," *Oceanic Fisheries Programme Technical Report*, No. 34 (South Pacific Commission (SPC): Noumea, New Caledonia, 1996), p. 4.23.

Barbieri, Maria Angela. Instituto de Fomento Pesquero (Chile), personal communications, March 4, 1997.

Barcia, Javier. Manager, LUBAR, personal communications, May 23 and June 5, 1996.

Bartoo, Norman W, Atilio L. Coan Jr. "An assessment of the Pacific swordfish resource," in Richard H. Strod, (ed.) *Planning the Future of Billfishes: Research and Management in the 1990s and Beyond* (National Coalition for Marine Conservation: Savannah, Georgia, 1989), pp. 137-151.

Bostock, Tim and Douglas Herdson. "Tiburón: Un nuevo recurso para la industria," *Aquanet*, September, 1984, N°3. pp. 130-137.

Buenaventura, Boris. Director Ejecutivo, Asociacion de Exportadores de Pesca Blanca, personal communications July 2 and July 3, 1996.

_____. PESYMAR, personal communications, May, 23 1995, March 10, 12, and 21, May 15, and July 24, 1996.

Bustamente, Rodrigo H. and Chantal Blanton. "Criterios de evaluación de factibilidad de una posible pesca deportiva comercial a desarrollarse en las aguas de la Reserva de Recursos Marinos de Galápagos," Estación Charles Darwin report, October 27, 1994, 7p.

Central Intelligence Agency. "Ecuador", *The World Fact Book*, 1994, (CIA: Washington, DC, 1995).

Calderón, Rodrigo. Manager, Ecuafresco, July 18, 1996.

Carocci, Fabio and Jacek Majkowski. *Pacific Tunas and Billfishes: Atlas of Commercial Catches,* (FAO: Rome, 1996).

Cevallos, Medardo. General Manager, PECIA, personal communications, March 10, 1997.

(El) Comercio, various issues.

Conservationist Network International, various press releases.

Correa, Luis. Vice-President, PEFREEXPORT, personal communications, June 12, 1996.

Corral, Gonzalo. Owner, PEFRESMAR, personal communications, May 22, 1996.

Crespo, Orlando. Asesor del Sub-Secretario de Pesca, Dirección General de Pesca, personal communications, May 15 and June 5-7, 1996.

Delger, Jorge. Owner, Oro Marisco, personal communications, May 24, 1996.

Delgado Pablo. Manager, Transmarina, personal communications, June 3-4, 1996.

Díaz, Jorge. Manager, Gondi, personal communications, July 24, 1996.

Dollar, Robert A. "Annual report of the 1993 Western Pacific longline fishery," *Southwest Fisheries Center Administrative Report* H-94-06, August, 1994, 38 p.

Eckert, Scott. Hubbs Sea World Research Institute, personal communications, September 25, 1997.

Ecuador Pesquero, Año 1 N°1 June-August, 1996.

Ecuadorean Government. Acuerdo N°001, July 20, 1989.

_____. Decree Law No. 1542, November 10, 1966.

_____. Resolución Ministerial N° 196, May 9, 1990.

_____. Subsecretario de Recursos Pesqueros, Decree N°212, July 31, 1990.

Escobar, Gabriel. "Ecuador counts losses to allegedly epic corruption," *Washington Post*, February 16, 1997, p. A33.

Expreso, various issues.

Food and Agriculture Organization (FAO). *Yearbook of Fishery Statistics*, various years.

FAO. "Ecuador," *Fishery Profiles*, February, 1988.

Farrington, S. Kip. *Fishing the Pacific: Offshore and On*, (New York: Coward-McCann, 1953), p. 110.

Félix, Fernando Felix. Fundación Ecuatoriana para el Estudio de Mamiferos Marinos, personal communications, August 8 and 12, 1997.

Félix, Fernando, Ben J.M. Haase, Jorge Samaniego, and Jennifer Oechsle. "New evidence of the presence of the South American sea lions *Otaria*

flavescens (Carnivora, Pinnipedia) in Ecuadorean waters," Estud. Oceanol., 1994, pp. 85-88.

Félix, Fernando, Ben J.M. Haase, Jorge Samaniego, and Jennifer Oechsle. "New evidence of the presence of the South American sea lions *Otaria flavescens* (Carnivora, Pinnipedia) in Ecuadorean waters," Estud. Oceanol., 1994, pp. 85-88

Félix, F. and J. Samaniego. "Incidental catches of small cetaceans in the artisanal fisheries of Ecuador," *Rep. Int. Whal. Commn.* (Special Issue 15), 1994, pp. 475-480.

Fishing News International, various issues.

Franco, Diego. President, FRESMAR, personal communications, May 23, and July 25, 1996.

Fujisaki, Ichiro. Counsellor, Embassy of Japan, "Shark-fishing charge denied," *The Times*, July 2, 1989.

González de Langarica, Joseba. Owner, Ecuafresco S.A., August 8, 1996.

Grove, Jack. Conservation Network International, internet message, July 11, 1996.

Hall, Martín A. "On bycatches," *Reviews in Fish Biology and Fisheries*, Volume 6, 1966. p. 319-352.

Holland, Fiona. "Fin soup demand threatens Galápagos sharks," *Eastern Star*, May 19, 1995.

Honma, Nisikawa, Yueyanagi, and Kikawa. *Average Distribution of Larval Oceanic Species of Scombroid Fishes, 1956-81* (Far Seas Fisheries Research Laboratory: Shimizu, Japan, 1985), Series S No. 12.

Hoy, various issues.

Hurtado, Mario. "Registros de anidación de la tortuga negra, *Chelonia mydas*, en las Islas Galápagos," *Boletin Científico y Técnico*, Vol. VI, No. 3, (Instituto Nacional de Pesca: Guayaquil, 1984). p. 77.

Hurtado, Mario G., Gerardo Corrales, and Kathina Muentes. "Participación de estudiantes universitarios en el programa de tortugas marinas," *Boletin Informativo*, Vol. 2. No. 5. (Instituto Nacional de Pesca: Guayaquil, September 1981), pp. 27-28.

IATTC. *Quarterly Report* July-September, 1995 (IATTC: La Jolla, California, 1995), p. 24

Industrias Pesqueras (Spain), various issues.

Instituto Nacional de Pesca (INP). "Apuntes e informaciones sobre las pesquerias en la provincia de Manabi," *Boletin Informativo*, Vol. 1, N°2 (INP: Guayaquil, 1964), 64p.

INP. "Apuntes e informaciones sobre las pesquerias en las provincias del Guayas y Los Rios," *Boletin Informativo*, Vol. 1, N°4 (INP: Guayaquil, 1964), 84p.

Jaramillo del Castillo, Raul, Pedro Valverde A., Domingo Quiroga. "Apuntes e informaciones sobre las pesquerías en la provincia de El Oro," *Boletin Informativo*, Vol. 1, N°1 (INP: Guayaquil, December, 1963), 30p.

Koplin, Steve. NMFS, personal communications, December 27, 1996.

Loesch, Harold. "Observaciones de ballenas en aguas ecuatorianas," *Boletin Cientifico y Tecnico*, Vol. 1, No. 4 (Instituto Nacional de Pesca: Guayaquil, June, 1966).

Marín, Cecilia. Biologist, Instituto Nacional de Pesca, personal communications, May 9 and June 3, 1997.

Marine Turtle Newsletter, June 1987.

Marquez, Rene. Mexican National Turtle Coordinator, comments at Mexican-United States Fishery Cooperation Talks, September 4, 1997, Huatulco, Mexico.

Martínez, Carlos. "Prospección de atunes y peces espadas en el Océano Pacífico oriental al este de los 110°W: Segundo semestre de 1971," (IFOP N° inven: 740002), December, 1974.

Merlo, Marcelo. Executive Secretary of the Committee of Business Chambers and Business Associations, Quito as cited by Thomas T. Vogel Jr., "Foreigners rang early alarm on Ecuador," *Wall Street Journal*, February 10, 1997. p. A14.

Mora L., Gonzalo. "Breve memoria del puerto de Manta en el campo pesquero," undated report provided by ATUNEC on February 20, 1997.

Moreano Hernán, General Manager, Astinave, personal communications, June 6, 1996.

Naritoshi, Cho. *"An attempt to clarify genetic stock structure of swordfish using nuclear gene markers,"* paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

Ormaza, Franklin. Director, Instituto Nacional de Pesca, personal communications, May 30, 1996.

Ortega, Doris. Biologist, INP, personal communications, May 12, 1997.

Parque Nacional de Galápagos (PNG). Oficio 1163-94, August 29, 1994.

Paez, Alexandra. Commercial Manager, Productos del Mar Santa Rosa Cia. Ltda. (PROMAROSA), April 23-24 and July 10, 1997.

Palacios, D.M., F. Felix, L. Florez-Gonzalez, J.J. Capella, D. Chiluiza, and B. Haase. "Sightings of Galapagos sea lions (*Zalphus californianus wollebaeki*) on the coasts of Colombia and Ecuador," *Mammalia*, 1997, Vol. 61:1, pp. 114-116.

Papastavron, V., S.C. Smith, and H. Whitehead. "Comportamiento del buceo de la ballena de esperma *Physeter macrocephalus*, frente a las Islas Galápagos," *Canadian Journal of Zoology*, Vol. 67, No. 4, pp. 839-846.

Parker, Peggy. "South America looks to the future," *Seafood Business*, November/December, 1995, pp. 16-20.

Perotti, Maria Gabriella. Vice President, TRANSMARINA, personal communications, September 20, 1996.

Polatty, Richard J. "Galápagos update," Internet message, May 30, 1995.

Presidential Proclamation, September 19, 1985.

Programa de Cooperación Técnica para la Pesca. Unión Europea-VECEP, June 11, 1996.

Quiroga, Domingo and Aníbal Orbes Armas. "Apuntese informaciones sobre las pesquerias en el Archipielago de Colon," *Boletin Informativo*, Vol. 1, N°5 (INP: Guayaquil, 1964), 18p.

_____ "Apuntese informaciones sobre las pesquerias en la provincia de Esmeraldas," Vol. 1, N°6 (INP: Guayaquil, 1964), 26p.

Reeb, Carol and Barbara Block. "Genetic analysis of Pacific swordfish populations using mtDNA and microsatellite markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

Rey, Fernando. INPA, personal communications, April 8, 1997;

Reyes, Eusebio. Manager, Agrol S.A., personal communications, July 24, 1996, and February 18-20, and March 10, 1997.

Robinson, Gary, Friedemann Koster, and José Villa. "Reporte sobre el varamiento de las ballenas gansas, *Ziphius cavirostris*, en Las Islas Galapagos," *Boletin Cientifico y Tecnico*, Vol. VI, No. 3 (Instituto Nacional de Pesca: Guayaquil, 1984), pp. 161-163.

Salas, Ramon. SIPESA (Peru), personal communications, August 27, 1997.

Schwarz, Otto. President, MARDEX, personal communications, May 16, 1996.

Seafood Leader, various issues.

Secler, David. U.S. Embassy, Quito, personal communications, October 8, 1993.

Tecno Agro, Ed. 7, 1996, p. 38.

(El) Telegrafo, June 6, 1989.

Tomczak, Mathias and J. Stuart Godfrey. *Regional Oceanography: An introduction* (Elsevier Science Inc.: Tarrytown, New York, 1994),

Torres Navarrete, Luís. Asesor Tecnico, Subsecretar ía de Recursos Pesqueros, personal communications, September 24, 1993.

Tórrez, Alfredo. Manager, CONSEMAR, personal communications, May 30, and June 5, 1996.

Trites, A.W. "Thermal budgets and climate spaces: "The impact of weather on the survival of Galapagos (*Arctocephalus galapagoensis* Heller) and northern fur seal pups (*Callorhinus ursinus* L.)," *Funct. Ecol.*, Vol. 4, no. 6, 1990, pp. 753-768.

U.S. Foreign Commercial Service, Quito. Response to request, September 4, 1997

U.S. Embassy, Quito. Various messages, July 10, 1990; April 23 and 30, 1992; and September 22, 1993.

Uozumi, Yuji and Kotaro Yokawa. "Country report for the swordfish fisheries in the Pacific Ocean," paper delivered at the Second International Swordfish Symposium, March 3, 1997,

Valladares, Alfredo Serrano. Diputado for Galápagos Province, personal communications, May 23, 1997.

Villón, Carlos. Fisheries Researcher, INP, personal communications, May 9, 1997.

Washington Post, October 14, 1996.

Weidner, Dennis, Tom Revord, Randy Wells, and Amin Manuar. "Ecuador," *World Shrimp Culture*, Vol. II, Part 3 (NMFS: Silver Spring, Maryland, 1992)

Weidner, Dennis and David Hall. "Latin America", *World Fishing Fleets*, Vol IV (NMFS Silver Spring, Maryland, 1993).

Wildman, Mark. "Asia" World Swordfish Fisheries, Vol. 3 (NMFS: Silver Spring, Maryland, 1996).

Wyrtki, Klaus. "Circulatiin and water masses in the eastern equatorial Pacific Ocean," *Oceanology and Limnology*, 1967, pp. 117-147.

ENDNOTES

SECTION I. (FISHING INDUSTRY OVERVIEW)

1. Dennis Weidner and David Hall, "Latin America", *World Fishing Fleets*, Vol IV (Silver Spring, Maryland, 1993), p. 359. Whitefish are high-quality species, usually groundfish, with white flesh. However, the Ecuadoreans also include some pelagic species such as dorado.

2. "Ecuador", *The World Fact Book*, 1994, (CIA: Washington, D.C., 1995). p. 124.

3. For details see Dennis Weidner, Tom Revord, Randy Wells, and Amir Manuar, "Ecuador," *World Shrimp Culture*, Vol. II, Part 3 (NMFS: Silver Spring, September 1992), pp. 883-949.

4. IATTC, *Quarterly Report* July-September 1995 (IATTC: La Jolla, California, 1995), p. 24.

5. Boris Buenaventura, Owner, PESYMAR, personal communications, March 10, 1997.

6. U.S. Embassy, Quito, April 23, 1992.

7. U.S. Embassy, Quito, April 23, 1992.

8. "La industria atunera", *Ecuador Pesquero*, Año 1 N° 1, June-August 1996, pp. 18-19.

9. FAO, *Yearbook of Fishery Statistics* (commodities), various years.

10. Ecuador conducts the largest dorado fishery in the eastern tropical Pacific (ETP). Several good studies exist describing this fishery. See J.R. Scott, "A review of the dorado fishery of Ecuador," *Inf. Int.* (Instituto Nacional de Pesca, 1992), 34p. and K.R. Patterson and J. Martinez, "Exploitation of the dolphin-fish *Coryphaena hippurus* L. off Ecuador: Analysis by length-based virtual population analysis," *Fishbyte*, December 1991, pp. 21-23.

11. David Secler, U.S. Embassy, Quito, personal communications, October 8, 1993.

12. U.S. Embassy, Quito, September 22, 1993.

13. Buenaventura, *op. cit.*, March 21, 1997.

14. For details on the Ecuadorean aquaculture industry see Weidner, et. al., "Ecuador", *op. cit.*, pp. 883-949.

15. As recently as the 1970s the artisanal sector was extremely primitive, incapable of supplying high-quality product. The Institute National de Pesca (INP) during the 1960s published an excellent series of reports prepared with FAO assistance describing the artisanal fishery in coastal provinces. Raul Jaramillo del Castillo, Pedro Valverde A., Domingo Quiroga, "Apuntes e informaciones sobre las pesquerías en la provincia de El Oro," *Boletin Informativo*, Vol. 1, N°1 (INP: Guayaquil, December 1963), 30p.; Instituto Nacional de Pesca, "Apuntes e informaciones sobre las pesquerías en la provincia de Manabi," *Boletin Informativo*, Vol. 1, N°2 (INP: Guayaquil, 1964), 64p.; INP, "Apuntes e informaciones sobre las pesquerias en las provincias del Guayas y Los Rios," *Boletin Informativo*, Vol. 1, N°4 (INP: Guayaquil, 1964), 84p.; Domingo Quiroga and Aníbal Orbes Armas, "Apuntes e informaciones sobre las pesquerias en el Archipielago de Colon," *Boletin Informativo*, Vol. 1, N°5 (INP: Guayaquil, 1964), 18p.; and Domingo Quiroga and Aníbal Orbes Armas, "Apuntes e informaciones sobre

las pesquerias en la provincia de Esmeraldas," *Boletin Informativo*, Vol. 1, N°6 (INP: Guayaquil, 1964), 26p.

16. A good recent review of Ecuadorean fishing industry developments is available in Peggy Parker, "South America looks to the future," *Seafood Business*, November/December 1995, pp. 18, 20.

17. "Ecuador Pesquero", *Editorial*, Vol. 1, N° 1, June-August 1996. p. 3.

SECTION II. (SPECIES)

18. Unlike most other countries, Ecuador claims a 200-mile Territorial Sea (TS) instead of an Exclusive Economic Zone. Ecuador has not signed the 1982 Law of the Sea Convention. The Government in addition has established special area closures which it requires foreign fishing vessels to avoid when transiting the country's 200-mile zone. The Government has also established mandatory navigational routes to keep vessels at least 125 kilometers (km) north and 233 km south of the Galápagos Archipelago. Ecuadorean note to IMCO, May 2, 1980. The U.S. and other Governments have protested the TS claim.

19. Even in the better studied north Pacific, very limited tagging data is available. Christofer Boggs and John Gunn, "Status of tagging programs and swordfish movement," paper delivered at the Second International Swordfish Symposium, Turtle Bay, Oahu, Hawaii, March 5, 1997.

20. See the Latin American overview of this report for a review of theories on the stock structure of Pacific swordfish.

21. This behavior appears most pronounced in areas of strong current flows such as the Humboldt Current and Gulf Stream. Other observers have not noted this association with currents in other areas and seasons. See the Chilean and Venezuelan chapter of this report for more details.

22. Some observers are justifiably cautious about using the limited catches to date to conclude that swordfish are not abundant in Ecuadorean coastal waters, especially as the longline fishermen have targeted tunas. Actual catches are, of course, not necessarily a good indicator of abundance, but they are currently the only indicators available to the authors and should not be discounted. Ecuadorean fishermen are reporting improved swordfish catches in 1996-97, but this appears to reflect both a change in grounds (further away from the mainland coast beyond the Galápagos) and fishing strategy (directed swordfish sets).

23. Buenaventura, *op. cit.*, March 21, 1997.

24. Fabio Carocci and Jacek Majkowski, *Pacific Tunas and Billfishes: Atlas of Commercial Catches,* (FAO: Rome, 1996), map 13.

25. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

26. For details see the Chilean chapter of this report.

27. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

28. The utility of the Japanese longline data is severely limited because swordfish was not the principal target species. The authors believe that using the resulting data to assess abundance may be somewhat more valid than to assess seasonality. The reader, however, needs to bear in mind the significant limitations of the data. The authors are attempting to present the existing data in an effort to make preliminary assessments within the time frame of this research project. In fact adequate data simply does not exist at this time that can be used to form any firm conclusions. While the data, given its limitations, is not definitive, it does provide some useful indicators for further research.

29. Available Ecuadorean catch data is limited. The best and longest time-line data available are probably estimates computed from foreign, especially U.S. import data (appendix B2a). In addition, the catch data and import data that has been compiled is compromised because swordfish was a largely incidental catch. Thus trends in domestic swordfish catches may reflect varying strategies used to target other species, primarily tunas.

30. FAO data shows a massive decline in 1993. U.S. import data shows a moderate declines in 1992-93 and a substantial decline in 1994 (appendix B2a).

31. See the Chilean chapter of this report.

32. See figure 1 displaying the geographic distribution of swordfish catches in Yuji Uozumi and Kotaro Yokawa, "Country report for the swordfish fisheries in the Pacific Ocean," paper delivered at the Second International Swordfish Symposium, March 3, 1997, Turtle Bay, Oahu, Hawaii, p. 6 and Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

33. Swordfish catches and yields and yields would of course be affected by strategies aimed at the target species. These strategies in the southeastern Pacific are fairly uniform. Thus the swordfish by-catch data would appear to offer a reasonable estimate of abundance if used cautiously. The readers, however, need to bear in mind the limitations of using fisheries related data, especially from a fishery targeted at tunas.

34. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 3.

35. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*,

36. Carol Reeb and Barbara Block, "Genetic analysis of Pacific swordfish populations using mtDNA and microsatellite markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

37. Naritoshi Cho, "An attempt to clarify genetic stock structure of swordfish using nuclear gene markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

38. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ..., *op. cit.*, pp. 80-85.

39. For details see the Chilean chapter of this report.

40. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13 and Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

41. Freddy Arocha, Universidad de Oriente, personal communications, July 7, 1997. The limitations of using the data are discussed in more detail in the Colombian report and thus will not be repeated here.

42. Swordfish off Costa Rica and Nicaragua during 1991-93 were prevalent during the third quarter of the year while further north off the Baja and California they were most prevalent during the fourth quarter. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

43. Uozumi and Yokawa, "Country report ...," *op. cit.*; Nakano, "Stock status ...," *op. cit.*; Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ..., *op. cit.*; Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, maps 8-11 and 13.

44. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, maps 8-11 and 13.

45. Japanese yield data suggest that extensive offshore exchanges appear to occur from October through January, but very limited exchanges are noted in coastal waters. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

46. The most comprehensive Pacific study of oceanic fish larvae has been conducted by the Japanese National Research Institute of Far Seas Fisheries (NRIFSF). Researchers with the NRIFSF failed to find any swordfish larvae east of 108°W, although they did not test waters south of 12°S. Nisikawa, Honma, Yueyanagi, and Kikawa, *Average Distribution of Larval Oceanic Species of Scombroid Fishes, 1956-81* (Far Seas Fisheries Research Laboratory: Shimizu, Japan, 1985), Series S No. 12. Other larval studies have included: CALCOFI, EASTROPAC 1 and II, and the Soviets *R/V Akademick Kurchatov* (cruise 17). They have all failed to find swordfish larvae east of 108°W. While these surveys were not designed specifically for swordfish, they did encounter larvae of similar species (such as frigate mackerel and sailfish). If swordfish larvae had been present--the researchers would have presumably also have encountered some. Larvae of several other oceanic species such as bigeye and yellowfin tuna were also absent or extremely rare. Researchers are unsure as to why spawning does not appear to be taking place in the ETP, despite appropriate temperatures and salinities. Robert Humphreys, "Review of larvae and juvenile distributions with inference towards spawning habitat," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

47. Nisikawa *et. al.*, "Average distribution...", *op. cit.*, 1985.

48. Maria Angela Barbieri, IFOP, personal communications, March 4, 1997; Fernando Rey, Instituto Nacional de Pesca y Acuicultura (INPA) (Colombia), personal communications, April 8, 1997; and Emira Antonetti, Instituto del Mar de Peru (IMARPE), personal communications, May 19, 1997.

49. Cecilia Marín, INP, personal communications, May 9, 1997 and Doris Ortega, INP, personal communications, May 12, 1997.

50. Marín, *op. cit.*, May 9, 1997 and Ortega, *op. cit.*, May 12, 1997.

51. Buenaventura, *op. cit.*, March 21, 1997.

52. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ..., *op. cit.*, pp. 80-85.

53. For details see the Chilean chapter of this report.

54. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ..., *op. cit.*, pp. 81-82.

55. Carocci and Majkowski, *Pacific Tunas and Billfishes*, *op. cit.*, map 13.

56. Carocci and Majkowski, *Pacific Tunas and Billfishes*, *op. cit.*, map 13.

57. Boris Buenaventura, owner, PESYMAR, personal communications, March 12, 1997.

58. Buenaventura, *op. cit,* March 12, 1997.

59. The study focused primarily on tuna, but there was a swordfish by-catch reported. Carlos Martínez, "Prospección de atunes y peces espadas en el Océano Pacífico oriental al este de los 110°W: Segundo semestre de 1971," (IFOP N° inven: 740002), December 1974.

60. Norman W. Bartoo, Atilio L. Coan Jr., "An assessment of the Pacific swordfish resource," in Richard H. Strod, (ed.) *Planning the Future of Billfishes: Research and Management in the 1990s and Beyond* (National Coalition for Marine Conservation: Savannah, Georgia, 1989), pp. 143-144.

61. Uozumi and Yokawa, "Country report ...," *op. cit.* p. 6.

62. Nakano, "Stock status ...," *op. cit.* figure 2.

63. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

64. Boris Buenaventura, Executive Director, Asociación de Exportadores de Pescado Blanco, May 15, 1996. Sr. Buenaventura is also the owner of PESYMAR.

65. S. Kip Farrington, Jr., *Fishing the Pacific: Off Shore and On* (New York: Coward-McCann, 1953), pp. 108-110.

66. Otto Schwarz, President, MARDEX, personal communications, May 16, 1996.

67. Franklin Ormaza, Director, Instituto Nacional de Pesca, personal communications, May 30, 1996.

68. Eusebio Reyes, Manager, AGROL, personal communications, July 24, 1996, and February 19, 1997.

69. Nakano, "Stock status of swordfish ...," *op. cit.*, fig. 8.

70. For details see the Chilean chapter of this report.

71. The fact that all the Spanish fishermen withdrew indicates that it was not a problem related to the operations of a single vessel or company, but wider systemic developments such as declining yields.

72. The Spanish operate out of Peruvian ports. For details see the Peruvian chapter of this report.

SECTION III. (FISHING GROUNDS)

73. Mathias Tomczak and J. Stuart Godfrey, *Regional Oceanography: An introduction* (Elsevier Science Inc.: Tarrytown, New York, 1994), p. 144.

74. An excellent review of the current structure in the ETP is available in Klaus Wyrtki, "Circulation and water masses in the eastern equatorial Pacific Ocean," *Oceanology and Limnology*, 1967, pp. 117-147.

75. Tomczak and Godfrey, *Regional Oceanography*, *op. cit.*, p. 119.

76. Current information on the developing 1997 El Niño event is available on a NOAA internet site: http://www.ogp.noaa.gov/enso/

77. The relationship between temperature and swordfish abundance is discussed in more detail in the Colombian chapter of this report.

78. Buenaventura, *op. cit.*, March 21, 1997.

79. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

80. A more complete collection of recent SST in the eastern Pacific are included in the Chilean chapter of this report.

81. Carocci and Majkowski, *Pacific Tunas and Billfish,* op. cit., map 13.

82. Richard Parrish, "Regime scale climatic variations in the north Pacific and implications for highly migratory species," paper delivered at the Second International Swordfish Symposium, Turtle Bay, Oahu, Hawaii, March 5, 1997.

83. Tomczak and Godfrey, *Regional Oceanography*, *op. cit.*, p. 126.

84. Jack Hogan as cited in Roger Fitzgerald, "Of mercenaries and monofilament," *Seafood Leader* May-June, 1996, p. 69.

85. Guillermo Podesta, "Aspects of swordfish oceanography in the Atlantic," Second International Pacific Symposium, Turtle Bay, Hawaii, March 4, 1997.

86. Boris Buenaventura, Executive Director, Asociación de Exportadores de Pesca Blanca, personal communications May 23, 1995. (For details on fishing operations, see "Fleet Operations and Gear.")

87. "Illegal fishing for sharks in the Galápagos," *El Comercio*, September 10, 1994.

88. Fiona Holland, "Fin soup demand threatens Galápagos sharks," *Eastern Star*, May 19, 1995.

89. Allison Abbott, "Fishermen fight rangers in conservation battle for Galápagos," *Time* April 17, 1997, p. 638.

90. Weidner and Hall, "Latin America...", *op. cit.*, 1993. p. 364. For further details see the Colombian chapter of this report.

91. For details see Weidner and Hall, "Latin America," *op. cit.*, pp. 428-449.

92. Buenaventura, *op. cit.*, March 21, 1997.

93. Buenaventura, *op. cit.*, May 23, 1996.

94. Buenaventura, *op. cit.*, March 10, 1997.

SECTION IV. (FLEET)

95. Programa de Cooperación Técnica para la Pesca, Unión Europea-VECEP, June 11, 1996.

96. "Pesca artesanal", *Ecuador Pesquero*, Vol. 1, N°1, June-August 1996, pp. 9.

97. Weidner and Hall, "Latin America...", *op. cit.*, 1993. p. 360.

98. Gonzalo Mora L., "Breve memoria del puerto de Manta en el campo pesquero," undated report provided by ATUNEC on February 20, 1997.

99. Ormaza, *op. cit.*, May 30, 1996.

100. Ormaza, *op. cit.*, May 30, 1996.

101. Orlando Crespo, Asesor del Sub-Secretario de Pesca, Dirección Nacional de Pesca, personal communications, May 15, 1996.

102. Ormaza, *op. cit.*, May 30, 1996.

103. Arriaga, *op. cit.*, April 7, 1997.

104. Buenaventura, *op. cit.*, May 15, 1996.

105. Buenaventura, *op. cit.*, May 23, 1996.

106. Ormaza, *op. cit.*, May 30, 1996.

107. Crespo, *op. cit.*, June 5, 1996.

108. Buenaventura, *op. cit.*, May 23, 1996.

109. Crespo, *op. cit.*, June 5, 1996.

110. As estimated in 1995 by the Proyecto de Pesca Artesanal, Instituto Nacional de Pesca. Ormaza, *op. cit.*, May 30, 1996.

111. Ormaza, *op. cit.*, May 30, 1996.

112. Foreign flag vessels can fish in Ecuadorean waters if they sign association contracts with local companies. (See "Government Agencies and Policies".)

113. Pablo Delgado, Manager, Transmarina, personal communications, June 3, 1996.

114. Luís Torres Navarrete, Asesor Tecnico, Subsecretaría de Recursos Pesqueros, personal communications, September 24, 1993.

115. Tim Bostock and Douglas Herdson, "Tiburón: Un nuevo recurso para la industria," *Aquanet*, September 1984, N° 3. p. 133.

116. Torres Navarrete, *op. cit.*, September 30, 1993.

117. Crespo, *op. cit.*, May 15, 1996.

118. Departamento Administración Pesquera, Subsecretaría de Recursos Pesqueros, Ministerio de Comercio Exterior, Industrialización y Pesca, personal communications, August 14, 1997.

119. Crespo, *op. cit.*, June 5, 1996.

120. Buenaventura, *op. cit.*, May 15, 1996.

121. For a more detailed description of the Japanese longliners see Wildman "Japan", *op. cit.*

122. Bostock and Herdson, "Tiburón: Un nuevo recurso...," *op. cit.*, p. 133.

123. Crespo, *op. cit.*, June 7, 1996.

124. Ichiro Fujisaki, Counsellor, Japanese Embassy, "Shark-fishing charge denied," *The Times*, London, July 2, 1989.

125. Delgado, *op. cit.*, June 3, 1996.

126. This does not include several other Japanese owned longliners which were reportedly operating under flag-of-convenience flags.

127. Schwarz, *op. cit.*, May 21, 1996.

128. Bostock and Herdson, "Tiburón: Un nuevo recurso...," *op. cit.*, p. 133.

129. Crespo, *op. cit.*, June 5, 1996.

130. Crespo, *op. cit.*, June 5, 1996.

131. Weidner and Hall, "Latin America", *op. cit.*, pp. 20-27.

132. Anonymous source, personal communications, May 30, 1996.

SECTION V. (SHIPYARDS)

133. Buenaventura, *op. cit.*, May 23, 1996.

134. Crespo, *op. cit.*, June 5, 1996.

135. Eusebio Reyes, Manager, Agrol S.A., personal communications, February 18, 1997.

136. Hernán Moreano, General Manager, Astinave, personal communications, June 6, 1996.

137. Crespo, *op. cit.*, June 5, 1996.

138. Moreano, *op. cit.*, June 6, 1996.

SECTION VI. (FLEET OPERATIONS AND GEAR)

139. Crespo, *op. cit.*, May 15, 1996.

140. Crespo, *op. cit.*, May 15, 1996.

141. Farrington, *op. cit.*, p. 110.

142. Ormaza, *op. cit.*, May 30, 1996.

143. Ormaza, *op. cit.*, May 30, 1996.

144. Holland, "Fin soup ...," *op. cit.*

145. Buenaventura, *op. cit.*, May 15, 1996.

146. This estimate is based on a total of 150 hooks and a spacing of 30 m between hooks. Eusebio Reyes, Manager, Agrol, personal communications, February 20, 1997.

147. Ormaza, *op. cit.*, May 30, 1996.

148. Crespo, *op. cit.*, May 15, 1996.

149. Schwarz, *op. cit.*, May 16, 1996.

150. Gonzalo Corral, owner, PEFRESMAR, personal communications, May 22, 1996.

151. Jorge Delger, Owner, Oro Marisco, personal communications, May 24, 1996.

152. Alfredo Serrano Valladares, Diputado for Galápagos Province, personal communications, May 23, 1997.

153. Buenaventura, *op. cit.*, March 24, 1997.

154. Schwarz, *op. cit.*, May 21, 1996.

155. Reyes, *op. cit.*, February 20, 1997.

156. Ormaza, *op. cit.*, May 30, 1996.

157. Buenaventura, *op. cit.*, May 15, 1996.

158. Schwarz, *op. cit.*, May 16, 1996.

159. "No! a las redes a la deriva ó trasmallo electrónico!," *Tecno Agro*, Ed. 7, 1996, p. 38.

160. Buenaventura, *op. cit.*, March 24, 1997.

161. Crespo, *op. cit.*, May 15, 1996.

162. Buenaventura, *op. cit.*, March 10, 1997.

163. Buenaventura, *op. cit.*, March 24, 1997.

164. See the Peruvian chapter of this report for details.

165. Farrington, *Fishing the Pacific*, *op. cit.*, pp. 108-110.

166. Conservationist Network International, "Galápagos: The new sport fishing capital of the world?" press release, CNIPR7a.95, June 3, 1995.

167. Buenaventura, *op. cit.*, July 2, 1996.

168. Jack Grove, Conservation Network International, internet message, July 11, 1996.

169. PNG oficio 1163-94, August 29, 1994.

170. Rodrigo H. Bustamente and Chantal Blanton, "Criterios de evaluación de factibilidad de una posible pesca deportiva commercial a desarrollarse en las aguas de la Reserva de Recursos Marinos de Galápagos," Estación Charles Darwin report, October 27, 1994, 7p.

171. Conservation Network International, "Galápagos: The madness continues," press release, CNIPR 6.95, June 1995.

172. Richard J. Polatty, "Galápagos update," Internet message, May 30, 1995.

173. Abbott, "Fishermen fight rangers ...," *op. cit.*, p. 638.

174. Grove, *op. cit.*, July 11, 1996.

175. Coral, *op. cit.*, May 22, 1996.

SECTION VII. (CATCH)

176. Ormaza, *op. cit.*, May 30, 1996.

177. Buenaventura, *op. cit.*, March 12, 1997.

178. U.S. import data is not a perfect reflection of catch trends. It will not reflect, for example, the small quantity of swordfish caught by artisanal fishermen and marketed domestically. Most of the catch of acceptable quality, however, is landed and exported as fresh product, primarily to the United States. (See "Markets".) Thus the authors believe that U.S. import data can be used to roughly estimate Ecuadorean domestic catches (appendix B2d). The frozen product imported by Japan and the European Union is probably swordfish landed by associated foreign longliners which are equipped with freezers.

179. The INP has kindly provided extensive catch data to the authors. The data provided at different times and by different researchers has varied (appendices B2a, B2b1-2, and B2c1-2). The authors have been unable to resolve the discrepancies between these sources. As a result, the most-recently supplied data (appendix B2a and B2b2) is the data primarily used in this report.

180. Bostock and Herdson, "Tiburón: Un nuevo recurso...," *op. cit.*, p. 133.

181. Paterson and Martinez, "Exploitation of the dolphin-fish ...," *op. cit.*, p. 21.

182. For details on these companies see "Companies."

183. There were probably Japanese imports prior to 1986, but that data is not available to the authors.

184. Crespo, *op. cit.*, June 7, 1996.

185. Crespo, *op. cit.*, June 7, 1996.

186. Marín, *op. cit.*, June 3, 1997. The discrepancy between the estimated swordfish exports to Japan (appendix D3a) and INP landings data (appendix B2b2) could be due to several factors, especially the lack of a separate Japanese customs category for swordfish.

187. Crespo, *op. cit.*, June 7, 1996.

188. Ormaza, *op. cit.*, May 30, 1996.

189. The fact that the Japanese imports are frozen suggests that the primary source was the associated vessels landing high-quality frozen product.

190. Ormaza, *Op. cit.*, May 30, 1996.

191. Ormaza, *Op. cit.*, May 30, 1996.

192. The authors are unsure as to the source of the European imports. As it was frozen product, it may not have been landed by domestic fishermen. Several industry sources were unaware of significant shipments to the European Union. Buenaventura, *op. cit.*, March 21, 1997. It is possible that the product was supplied by associated foreign vessels.

193. As mentioned above, some of the catch may have been marketed in the European Union (appendix B2d). Even so, combined U.S. and EU shipments are only a fraction of quantity that the INP reports was caught (appendix B2a, B2b1-2, and B2c1-2).

194. Crespo, *op. cit.*, June 7, 1996 and the Departamento Administración Pesquera, *op. cit.*, August 14, 1997.

195. Buenaventura, *op. cit.*, March 24, 1997.

196. For details see the Chilean chapter of this report.

197. The authors have obtained several different data sets from the INP. INP staff kindly offered to explain the discrepancies, but at the time of publication had not yet done so. It is likely that if the species continues to increase in importance that more reliable data sets will become available.

198. Reyes, *op. cit.*, February 19, 1997.

199. Alexandra Paez, Commercial Manager, Productos del Mar Santa Rosa Cia. Ltda. (PROMAROSA), personal communications, June 24, 1997.

200. Departamento Administración Pesquera, *op. cit.*, August 14, 1997.

SECTION VIII. (PORTS)

201. Alfredo Tórrez, Manager, CONSEMAR, personal communications, June 5, 1996.

202. Crespo, *op. cit.*, June 5, 1996.

203. Carlos Villón, Fisheries Researcher, INP, personal communications, May 9, 1997.

204. Gonzalo Mora L., "Breve memoria del puerto de Manta en el campo pesquero," undated report provided by the Asociación de Atuneros del Ecuador (ATUNEC) on February 20, 1997.

205. Buenaventura, *op. cit.*, May 15, 1996.

206. Schwarz, *op. cit.*, May 21, 1996.

207. Buenaventura, *op. cit.*, May 15, 1996.

208. Buenaventura, *op. cit.*, March 21, 1997. Air cargo companies operate flights from Manta which can accommodate planes as large as Boeing 707s. Much of the air cargo shipments from Manta are flowers and fish. One cargo plane operated by Million Air, a Miami-based cargo carrier owned by a Colombian company, loaded with fish and flowers, crashed in 1996. About 84 persons were killed or injured in the Manta neighborhood near the airport. "Cargo plane crashes in Ecuadorean city," *Washington Post*, October 14, 1996.

209. Mora, "Breve memoria ...", *op. cit.*

210. Villón, *op. cit.*, May 9, 1997.

211. Serrano Valladares, *op. cit.*, May 23, 1997.

212. Buenaventura, *op. cit.*, May 21, 1997.

SECTION IX. (TRANSSHIPMENT)

213. Villón, *op. cit.*, May 9, 1996.

SECTION X. (PROCESSING AND PRODUCTS)

214. Buenaventura, *op. cit.*, May 23, 1996.

215. Schwarz, *op. cit.*, May 16 ,1996.

216. Serrano Valladares, *op. cit.*, May 23, 1997.

217. Parker, "South America ...," *op. cit.*, p. 20.

218. Mark Wildman, "Asia" World Swordfish Fisheries, Vol. III (NMFS: Silver Spring, Maryland, 1997).

SECTION XI. (COMPANIES)

219. "No! a las redes...," *Tecno Agro*, *op. cit.*, Ed. 7, 1996, p. 38.

220. "Sector pesquero, sin Dios ni ley", *Tecno Agro*, Ed. 1996. pp. 27-28.

221. Eusebio Reyes, Manager, AGROL, personal communications, July 24, 1996, and February 19, 1997.

222. Medardo Cevallos, General Manager, PECIA, personal communications, March 10, 1997.

223. Alfredo Tórrez, Manager, CONSEMAR, personal communications, May 30, 1996.

224. Grove, *op. cit.*, July 11, 1996.

225. Rodrigo Calderón, Manager, Ecuafresco, July 18, 1996, and Joseba González de Langarica, Owner, Ecuafresco S.A., August 8, 1996.

226. "Ecuador mira hacia el Pacífico", *Ecuador Pesquero*, Vol. 1, N° 1 June-August 1996. p. 30.

227. Patricio Biteri, Manager, EMPROCEANICA, personal communications, January 15, 1997, and Madardo Cevallos, General Manager, PECIA, personal communications, March 10, 1997.

228. Another report indicates that the *Nautilus* is owned by CONSEPAC.

229. Diego Franco, President, FRESMAR, personal communications, May 23, and July 25, 1996.

230. Jorge Díaz, Manager, Gondi, personal communications, July 24, 1996.

231. "Se suspendió permiso de pesca a barco japones," *El Telegrafo*, June 6, 1989.

232. Javier Barcia, Manager, LUBAR, personal communications, May 23 and June 5, 1996.

233. Reyes, *op. cit.*, February 19, 1997.

234. Schwarz, *op. cit.*, May 16, 1996.

235. Delger, *op. cit.*, May 24, 1996.

236. Luis Correa, Vice-President, PEFREEXPORT, personal communications, June 12, 1996.

237. Corral, *op. cit.*, May 22, 1996.

238. "Ecuador mira hacia el Pacífico", *Ecuador Pesquero*, Vol. 1, N° 1 June-August 1996. p. 30.

239. Cevallos, *op. cit.*, March 10, 1997.

240. Reyes, *op. cit.*, February 19, 1997.

241. Buenaventura, *op. cit.*, May 30 and July 24, 1996.

242. Buenaventura, *op. cit.*, March 10, 1997.

243. Buenaventura, *op. cit.*, July 2, 1996.

244. Paez, *op. cit.*, July 10, 1997.

245. Paez, *op. cit.*, April 23, 1997.

246. Paez, *op. cit.*, June 24, 1997.

247. Pablo Delgado, Manager, TRANSMARINA C.A., personal communications, June 4, 1997.

SECTION XII. (MARKETS)

248. FAO, "Ecuador," *Fishery Profiles*, February 1988.

249. Buenaventura, *op. cit.*, March 24, 1997.

250. "Nuestros recursos marinos", *Ecuador Pesquero*, Vol. 1, N°, Junio-Agosto 1996, p. 22-23.

251. Buenaventura, *op. cit.*, May 15, 1996, and Schwarz, *op. cit.*, May 16, 1996.

252. FAO, "Ecuador" *op. cit.*

253. Significant exports to the United States had been reported in 1977 (appendix D2a), but the authors are unsure as to the origin of these shipments. They probably were product landed by foreign leased vessels (appendix A5a).

254. Some of the uncertainty concerning the Ecuadorean swordfish catch is due to the appearance in EU import data of shipments from Ecuador for the first time. If shipments of 60-80 t (85-115 t live weight) did take place in 1994-95 (appendix D4), it would help substantiate the sizeable catches reported by the INP (appendices B2a and B2b1-2). Even combined with U.S. imports, however, the total is still far short of the catch data INP is reporting. In addition, the imports are frozen product while Ecuadorean fishermen are mostly landing fresh swordfish. Several Ecuadorean company representatives interviewed by the authors are skeptical about such large shipments to the EU. It is possible that the swordfish reported by the EU, almost all frozen, may have been landed by associated foreign vessels which do land frozen product.

255. Delger, *op. cit.*, May 24, 1996.

256. Holland, "Fin soup ...," *op. cit.*

257. Swordfish may have constituted about one-third of billfish shipments if the species mix of exports to Japan reflected the same mix as catches. The swordfish shipments to Japan, however, may have been smaller given the strong market for the species in the United States.

258. The authors believe that much of this product is landed by Japanese longliners working in association with Ecuadorean companies. The species composition of these billfish shipments is unknown, but based on overall Japanese operations about one-third of the billfish catch is usually swordfish.

259. One local industry representative, however, reports somewhat larger shipments to the United States of 120 t in 1995. Buenaventura, *op. cit.*, May 15, 1996. It is possible that U.S. Customs understates swordfish imports as some product may have been included under miscellaneous marine fish. Steve Koplin, NMFS, personal communications, December 27, 1996. The authors note that shipments from Chile, for example, appear to be under-reported by U.S. Customs. For details see the Chile chapter of this report. Such mistaken classification by U.S. Customs seems most likely when the product involved has been processed into steaks or fillets that are not easily recognizable. This may explain much of the discrepancy with Chilean shipments because Chilean companies process a sizeable proportion of the catch. Ecuadorean companies currently process only minimal quantities.

260. NMFS estimates of Ecuadorean swordfish catches are based on calculating the live weight of imports as most of the Ecuadorean domestic catch is exported fresh to the United States (appendix B2). This estimate, however, may be invalid for 1994-95 as Ecuadorean companies may have marketed unusually large quantities of swordfish in the EU during 1994-95 (appendix D4).

261. "Depending on the goods and dependency of the orders, customs officials asked for important sums of money for each container imported." Marcelo Merlo, Executive Secretary of the Committee of Business Chambers and Business Associations (Quito) as cited by Thomas T. Vogel Jr., "Foreigners rang early alarm on Ecuador," *Wall Street Journal*, February 10, 1997, p. A14. U.S. Ambassador Leslie Alexander reported in January 1997, that one Ecuadorean customs agent demanded a $12,000 bribe to get an $8,000 container out of customs. Vogel, "Foreigners rang...," *op. cit.*, February 10, 1997. One estimate cited by Ambassador Alexander was that illegal payments may have totaled $100 million during the 6-month term of President Bucaram. Gabriel Escobar, "Ecuador counts losses to allegedly epic corruption," *Washington Post*, February 16, 1997, p. A33.

262. Merlo, *op. cit.*, February 10, 1997.

263. Buenaventura, *op. cit.*, February 12, 1997.

264. "A la conquista del Mercosur y Brasil", *Ecuador Pesquero*, Vol. 1, N°1, June-August 1996, pp. 33-34.

265. For details see the Brazilian chapter of this report.

SECTION XIII. (GOVERNMENT AGENCIES AND POLICIES)

266. "Sector pesquero, sin Dios ni ley", *op. cit*, pp. 27-28.

267. "Flota artesanal," *Ecuador Pesquero*, *op. cit.*

268. Buenaventura, *op. cit.*, March 10, 1997.

269. Ormaza, *op. cit.*, May 30, 1996.

270. "No! a las redes...," *Teco Agro*, *op. cit.*, Ed. 7, 1996, p. 38.

271. Decree Law No. 1542, November 10, 1966.

272. Note to IMCO, May 2, 1980.

273. Presidential Proclamation, September 19, 1985.

274. Weidner and Hall "Latin America", *op. cit.*, p. 364.

275. Weidner and Hall "Latin America", *op. cit.*, p. 364.

276. "Suspenden los permisos de pesca a navíos extranjeros," *El Universal*, November 14, 1991 and Seckler, *op. cit.*, October 8, 1993.

277. Available press reports confirm Government data on the foreign vessels (appendix A5a). One observer, for example, reports that there was a total of 12 foreign longliners operating within Ecuador's waters in 1982. Bostock and Herdson, "Tiburón: Un nuevo recurso ...," *op. cit.*, p. 133.

278. U.S. Embassy, Quito, September 30, 1993.

279. Ley de Pesca as described by Torres Navarrete, *op. cit.*, September 24, 1993.

280. U.S. Embassy, Quito, September 30, 1993.

281. Crespo, *op. cit.*, June 5, 1996.

282. Buenaventura, *op. cit.*, March 10, 1997.

283. Buenaventura, *op. cit.*, March 21, 1997.

284. Schwarz, *op. cit.*, May 16, 1996, and Crespo, *op. cit.*, June 5, 1996.

285. Ichiro Fujisaki, Counsellor, Embassy of Japan, "Shark fishing charge denied," *The Times* (London), July 2, 1989.

SECTION XIII. (GOVERNMENT AGENCIES AND POLICIES)

286. FAO, "Ecuador," *op. cit.*

287. Ormaza, *op. cit.*, May 30, 1996.

288. Luis Arriaga, Biologist, VECEP, personal communications, April 7, 1997.

289. Crespo, *op. cit.*, June 6, 1996.

290. "Exigente control de calidad", *Ecuador Pesquero*, Año 1 N°1, June-August 1996, pp. 35.

291. Programa de Cooperación Técnica Para la Pesca, Unión Europea-VECEP, *op. cit.*, June 11, 1996.

292. Luis Arriaga, Asesor Pesquero, Programa VECEP, personal communications, June 14, 1996.

SECTION XV. (BY-CATCH)

293. Buenaventura, *op. cit.*, March 24, 1997,

294. Buenaventura, *op. cit.*, March 12, 1997.

295. Bostock and Herdson, "!Tiburon!: Un nuevo recurso ...," *op. cit.*, pp. 130-137. The authors have observed artisanal fishermen during the 1980s landing large sharks. Dugouts were used as reefers and the sharks were then butchered on the beach.

296. Buenaventura, *op. cit.*, March 24, 1997,

297. Buenaventura, *op. cit.*, March 12, 1997.

298. Acuerdo Nº001, July 20, 1989.

299. "Illegal fishing for sharks in the Galápagos," *El Comercio*, September 10, 1994; "Navy reinforces vigilance," *Hoy*, September 10, 1994; "Marine resources," *Hoy*, September 13, 1994; and Jorge Vivanco, "Blind destroyers," *Expreso*, September 13, 1994.

300. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, maps 8-10.

301. Ormaza, *op. cit.*, May 30, 1996.

302. Buenaventura, *op. cit.*, March 12, 1997.

303. U.S. Embassy, Quito, "Toward a meaningful marine turtle protection policy," message number 4381, April 30, 1992.

304. Mario Hurtado G., Gerardo Corrales, and Kathina Muentes, "Participación de estudiantes universitarios en el programa de tortugas marinas," *Boletin Informativo*, Vol. 2. No. 5. (Instituto Nacional de Pesca: Guayaquil, September 1981), pp. 27-28, and Mario Hurtado, "Registros de anidación de la tortuga negra, *Chelonia mydas*, en las Islas Galápagos," *Boletin Científico y Técnico*, Vol. VI, No. 3, (Instituto Nacional de Pesca: Guayaquil, 1984). p. 77.

305. U.S. Embassy, Quito, "Ecuadorean compliance with USG marine mammal and turtle conservation statutes," message number 8389, July 10, 1990.

306. "Ecuador takes a giant step backwards," *Marine Turtle Newsletter*, June 1987.

307. Subsecretario de Recursos Pesqueros, Decree N°212, July 31, 1990.

308. Buenaventura, *op. cit.*, July 2, 1996.

309. "Turtle skins seized," *Fishing News International*, May 1985.

310. Kevin Bailey, Kevin. Peter G. Williams, and David Itano, "By-catch and discards in Western Pacific tuna fisheries: A review of SPC data holdings and literature," *Oceanic Fisheries Programme Technical Report*, No. 34 (South Pacific Commission (SPC): Noumea, New Caledonia, 1996).

311. The higher hook rates were reported within the U.S. 200-mile EEZ. Robert A. Dollar, "Annual report of the 1993 Western Pacific longline fishery," *Southwest Fisheries Center Administrative Report* H-94-06, August, 1994, pp. 9, 24-25.

312. Rene Marquez, Mexican National Turtle Coordinator, comments at Mexican-United States Fishery Cooperation Talks, September 4, 1997, Huatulco, Mexico.

313. While the satellite tracking devices were attached to only a few turtles, the preliminary results are striking. All of the tagged turtles moved due south toward Chile. Scott Eckert, Hubbs-Sea World Research Institute, personal communications, September 25, 1997.

314. Felix, *op. cit.*, August 8, 1997.

315. Fernando Félix, Ben J.M. Haase, Jorge Samaniego, and Jennifer Oechsle, "New evidence of the presence of the South American sea lions *Otaria flavescens* (Carnivora, Pinnipedia) in Ecuadorean waters," Estud. Oceanol., 1994, pp. 85-88. Biologists still do not agree on the nomenclature, but some Ecuadorean biologists are using *O. byronia* rather than *flavescens*. Some experts believe that this species is more common than *Z. californianus*, because of the number of carcasses found beached. There is no known resident colony of *O. flavescens* along the coast while a small non-reproductive colony has been noted on La Plata Island. Ecuadorean biologists also report another species, an unidentified a fur seal, that is infrequently observed along the mainland coast. They are currently using genetic testing in an effort to identify it. Fernando Felix, *op. cit.*, August 12, 1997.

316. See for example A.W. Trites, "Thermal budgets and climate spaces: The impact of weather on the survival of Galapagos (*Arctocephalus galapagoensis* Heller) and northern fur seal pups (*Callorhinus ursinus* L.)," *Funct. Ecol.*, Vol. 4, no. 6, 1990, pp. 753-768.

317. D.M. Palacios, F. Felix, L. Florez-Gonzalez, J.J. Capella, D. Chiluiza, and B. Haase, "Sightings of Galapagos sea lions (*Zalphus californianus wollebaeki*) on the coasts of Colombia and Ecuador," *Mammalia*, 1997, Vol. 61:1, pp. 114-116.

318. Bailey *et. al.*, "By catch and discards ...," *op. cit.*, table 4.7.

319. Dollar, "Annual report ...," pp. 24-25.

320. F. Félix and J. Samaniego, "Incidental catches of small cetaceans in the artisanal fisheries of Ecuador," *Rep. Int. Whal. Commn.* (Special Issue 15), 1994, pp. 475-480.

321. Resolución Ministerial N° 196, May 9, 1990.

322. V. Papastavron, S.C. Smith, and H. Whitehead, "Comportamiento del buceo de la ballena de esperma *Physeter macrocephalus*, frente a las Islas Galápagos," *Canadian Journal of Zoology*, Vol. 67, No. 4, pp. 839-846.

323. "Riesgo para la recuperación de la existencia de cachalotes en el Pacífico sureste debido al desarrollo de la pesca de la pota," *Aquarius*, July-December 1993.

324. Harold Loesch, "Observaciones de ballenas en aguas ecuatorianas," *Boletin Cientifico y Tecnico*, Vol. 1, No. 4 (Instituto Nacional de Pesca: Guayaquil, June, 1966). A good review of whaling in the southeastern Pacific is available in L. Arriaga M., "Actividad ballenera en el Pacífico suroriental," *Revista de Comision Permenente en el Pacífico Suroriental*, Vol. 5, 1976, pp. 165-172.

325. Gary Robinson, Friedemann Koster, and José Villa, "Reporte sobre el varamiento de las ballenas gansas, *Ziphius cavirostris*, en Las Islas Galapagos," *Boletin Cientifico y Tecnico*, Vol. VI, No. 3 (Instituto Nacional de Pesca: Guayaquil, 1984), pp. 161-163.

326. See the individual country chapters on Brazil, Chile, and Uruguay.

327. The authors have no specific data on Ecuador, but some useful background information is available on the western Pacific. Bailey, *et. al.* "By-catch and discards ...," *op. cit.*, p. 4.12.

328. Dollar, "Annual report ...," *op. cit.*, pp. 24-25.

329. "No! a las redes...," *Teco Agro*, *op. cit.*, Ed. 7, 1996, p. 38.

SECTION XVI. (INTERNATIONAL)

330. For details see the Costa Rican chapter of this study.

331. For details see the Central American chapters of this study, especially the Costa Rican chapter.

332. For details see the Costa Rican chapter of this study.

333. "Finfish market," Seafood Leader, July/August 1996, p.6.

334. "Colombia tampoco cumple," *Industrias Pesqueras*, June 10, 1995. p. 21.

335. Recent studies indicate that purse seiners take small amounts of billfish including an occasional swordfish. The number of swordfish taken varies significantly depending on the fishing strategy. Purse-seine fishermen setting on dolphin, for example, take only about three to five billfish per thousand short tons of yellowfin tuna. Purse seiners setting on schools and logs, however, report 12-94 billfish per thousand short tons of yellowfin. Martín A. Hall, "On bycatches," *Reviews in fish biology and fisheries*, Volume 6, 1966. p. 335.

336. Uozumi and Yokawa, "Country report ...," *op. cit.*, p. 6.

337. "Navy reinforces vigilance," *Hoy*, September 10, 1994; "Marine resources," and *Hoy*, September 13, 1994. Some of the charges, however, are somewhat fanciful. One commentator charged in 1994 that "... an entire fleet of Japanese boats, more than a hundred it is said, are trying to change their flags for Ecuadorean ones in order to fish the inshore waters of the Galápagos." Jorge Vivanco, "Blind destroyers," *Expreso*, September 13, 1994.

338. "Turtle skins seized," *Fishing News International*, May 1985.

339. "Se suspendió permiso de pesca a barco japones," *El Telegrafo*, June 6, 1989.

340. Fujisaka, "Shark-fishing ...," *op. cit.*

341. "Illegal fishing for sharks in the Galápagos," *El Comercio*, September 10, 1994.

342. National Fisheries Research and Development Agency (NFRDA), "Fishery statistics and fishing grounds for the Korean tuna longline fishery, 1988~1992," *Technical Report of NFRDA* (NFRDA: Seoul, December 1993), 465p.

343. Ramon Salas, SIPESA (Peru), personal communications, August 27, 1997.

344. For details see the Peruvian and Chilean chapters of this report.

345. For details see the Chilean chapter of this report.

346. Delger, *op. cit.*, May 24, 1996.

347. "Assumption of the number of tuna vessels reflagged to flags of convenience," *Suisan Keizai Shinbun*, July 29, 1992.

348. Fujisaki, "Shark-fishing..," *op. cit.*, July 2, 1989.

349. INFOPESCA, *op. cit.*, August 1, 1983.

350. Crespo, *op. cit.*, June 6, 1996.

351. Buenaventura, *op. cit.*, July 2, 1996.

352. Hall, *op. cit.*, "On bycatches," p. 335.

APPENDICES

Series A: Fleet
Series B: Catch
Series C: Agencies/Companies
Series D: Trade
- D1: Overall
- D2: EU
- D3: Japan
- D4: United States

Series E: Glossary

Appendix A1.--Ecuador. Artisanal and semi-commercial fleet by landing site and vessel type, 1995.

Vessel type*	Landing sites								Total
	Esmeraldas	Manta	San Mateo	Anconcito	Sta. Rosa	Engabao	Playas	Pto. Bolivar	
	Number of vessels								
Artisanal									
Fiberglass	420	510	143	237	447	-	-	-	1,747
Wooden boats	40	24	-	51	55	102	144	384	800
Canoes	121	-	-	-	-	-	-	50	171
Rafts	-	-	-	-	-	21	31	-	52
Sailboats	1	66	2	-	-	-	-	-	69
Semi-commercial**									
Wooden boats	-	33	2	-	-	-	-	-	35
Total	582	633	147	288	502	123	175	434	2,874

* The vessels are described in detail in the "Fleet" chapter.
** Many local observers describe these as advanced artisanal or semi-commercial vessels.
Source: Franklin Ormaza, Director, Instituto de Pesca, personal communications, May 30, 1996.

Appendix A2.--Ecuador. Manta-based fishing fleet, 1996.

Vessel type	Number of vessels
	Number
Artisanal/ outboard engines	3,680
Commercial/ inboard engine	196
Tuna purseseine/ up to 1,500 t	64
Foreign/ Association	31

Source: Escuela de Ciencias del Mar de la Universidad Eloy Alfaro de Manabí. Taken from Gonzalo Mora L., "Breve memoria del puerto de Manta en el campo pesquero," provided by the Asociación de Atuneros del Ecuador (ATUNEC) on February 20, 1997.

Appendix A3a.--Ecuador. Local commercial longlining fleet, 1996.

Company/ Vessel name	Length	Size		Year acquired or associated
		Capacity	Vessel	
	Meters	NRT	GRT	
AGROL (Manta)				
Company owned				
Miry Ann D@	NA	600		NA
CONSEMAR~(Esmeraldas)	NA	NA		NA
CONSEPAC (Manta)				
Associated (Foreign)	NA	NA	2,500	NA
ECUAFRESCO (Manta)				
Associated~~ (Domestic)				
Adonay	16	22		96
Angela Eugenia	12	10		91
Don César I	17	30		94
Don Ramón	16	22		93
Mirella	13	12		93
Umina 09	14	15		94
Associated (Domestic)				
Calipso	12	10		94
Don Juan Mero	15	18		94
Doña Rosario	17	30		96
Maria Angélica	12	10		94
Pelícano	14	15		93
EMPROCEANICA				
Lashkmy 1	NA	NA		NA
Lashkmy 2	NA	NA		NA
Centauro	NA	NA		NA
Nautilus	NA	NA		NA
FRESMAR (Manta)				
Company owned				
Altair	23	46		NA
Vessels (Domestic)*				
Alfaro	16	NA		NA
Don Enrique I	18	NA		NA
Don Enrique II	18	NA		NA
Don Jaime	21	NA		NA
Don Jaime II	22	NA		NA
Don Jorge	18	NA		NA
Julio Antonio	18	NA		NA
Patricia I	20	NA		NA
Patricia II	20	NA		NA
Soraya	22	NA		NA
Gondi (Manta)				
Angelica Maria	16	9		1995
Alfonso Gregorio	16	9		1995
Don Javier	16	9		1995
Sajea	16	9		1995
LUBAR (Manta)				
Company owned+				
Ana Belén	15	10		NA
Andrea	15	10		NA
Carlos Geovanny	15	10		NA
Carlos Humberto	15	10		NA
Don Rafael	15	10		NA
Javier Jr.	15	10		NA
Karla Tatiana	15	10		NA
Lolita	15	10		NA
Luciola II	15	10		NA
Maria Lorena	15	10		NA
Marimar	15	10		NA
Millo	15	10		NA
Nelly	15	10		NA
Associated				
Various (Foreign)	25	20-25		NA

MARDEX (Manta)			
Company owned			
Don Casi	14	6	1992
Enero**	NA	NA	NA
Gaviota	24	34	1994
Mana	15	8	1992
Martes	11	4	1991
Lucciola	17	15	1993
Lunes	14	16	1990
Pájaro Azul	12	4	1990
Viernes	16	10	1992
ORO MARISCO (Guayaquil)			
Company owned			
Don Casi II***	17	15	1993
Associated (Domestic)			
Others (3)	17	10^	NA
Pefresmar (Manta)			
Company owned			
Nizan	19	4E	1990
Barco de Progreso	25	10E	1996
Associated (Domestic)			
Others (28)	18#	4^E	NA
PEFREEXPORT (Manta)			
Associated (Domestic)			
Various (10)	15-25	NA	1995-1996
Pesquera Reyes (Manta)			
Company owned			
(powered-engine boats)			
Adonay I-X+++	25	25	NA
Adalberto	25	25	NA
Angel Jr.	20	5	NA
Carlos Enrique	25	25	NA
Cirilo I	23	20	NA
Cirilo II	18	15	NA
Cirilo III	18	16	NA
Coimbra	25	20	NA
Don César	25	20	NA
Don Eduardo	20	15	NA
Don Jhonny	25	20	NA
Ivan	20	15	NA
Los Mena	14	5	NA
Los Mena II	20	15	NA
María Angélica	25	20	NA
Posi	27	25	NA
Rey Adonay	35	30	NA
Simon Bolívar	27	25	NA
Soraya	27	25	NA
(Sailboats)			
Don José	15	10	NA
Don Juan	15	10	NA
Dos Hermanas	18	12	NA
Génesis	17	10	NA
Dragon del mar	16	10	NA
María Pilar	17	10	NA
Tuna Mar	18	10	NA
Yenifer	17	10	NA
PESYMAR (Manta)			
Associated###			
Kona Wind	28	NA	1996
Prime North Ecuador (Manta)			
Associated###			
Kona Wind	28	NA	1996

Transmarina (Guayaquil)			
Company owned			
Altar	50	154	1990
Altar # 7^^	NA	NA	NA
Altar # 10	55	NA	1996
Altar # 11	49	120	1995
Altar # 18++	50	261	1990
Altar # 68++	51	174	1991
Associated (Foreign)			
Daikoku Maru # 78	55	NA	##
Koei Maru # 11	55	NA	##
Kyoshin Maru # 3	55	NA	##
Kyoshin Maru # 8	55	NA	##
Kyoshin Maru # 10	55	NA	##
Fukujo Maru # 38	55	NA	##

E - Estimated
@ Purseseiner
~ This company does not own any vessels. However, they are associated with various large Japanese freezer longliners.
~~ These vessels are owned by company owners and not the company itself.

* These vessels are associated through special agreements with the company.
** This vessel sank in 1995.
*** This is, reportedly, the only Ecuadorean longliner targeting swordfish.
^ Average dimensions of the vessels associated.
^^ This vessel is owned by VENALUM a joint venture company between Transmarina and an unknown company.
+ These vessels were acquired from 1995-1996.
++ Sold in 1996 to an Equatorial Guinean company.
+++ These 10 vessels are all 25 m long and have a capacity of 25 tons.
These vessels were acquired from 1985-1993.
This vessel is owned by Prime North (New Zealand) but is operating for Prime North Ecuador, which is the joint venture company between Prime North and PESYMAR (Ecuador).
Source: Various

Appendix A3b.--Ecuador. Commercial longliners targeting swordfish, 1996-97.

Vessel Name	Company	Operations initiated**
Casi Dos	OROMARISCO	1995
César Enrique	César Fernández Cevallos Group	1996
Kona Wind	PESYMAR*	1996
Lady Esther	FRIGOLAB-San Mateo	1996
Unknown	Unknown	1996/97
Unknown	Unknown	1996/97

Note: These vessels in 1997 were targeting grounds west of the Galápagos.
* This vessel is a New Zealand-flagged longliner affiliated to PESYMAR.
** Year in which swordfish operations were initiated. Some of these vessels were previously deployed for tuna.
Note: There are approximately two other longliners targeting swordfish in addition to these four vessels.
Source: Boris Buenaventura, President, PESYMAR, March 21, 1997.

Appendix A3c.--Ecuador. Company longline fleets

Company	Created	Fleet*	
		Company	Foreign
AGROL	1995	1995	None
CONSEMAR	1984	None	1984**
CONSEPAC	NA	1996#	None
EMPROCEANICA	1992	NA	NA
FRESMAR	1992	1992	None
Gondi	1993	1995	None
LUBAR	1976	1995	NA
MARDEX	1987	1990	None
OROMARISCO	1991	1993	None
Pefresman	1990	1990	None
Pesquera Reyes	1984	1984	None
PESYMAR	1986	1996	None
TRANSMARINA	1981	1985	1985
USTI	NA	NA	NA***

* First year longline vessels acquired or foreign association contracts signed.
** Consemar representatives declined to indicate when they began association contracts with foreign companies, but it could have been as early as 1984.
*** The company has association contracts with foreign companies, but no information is available.
# The authors have no details on the company's mainland operations but the company deployed a large mothership and four launches off the Galápagos in 1996.
Source: Interviews with company representatives.

Appendix A3d.--Ecuador. Reflagged longliners

Name	Ownership*
Aldgeles II	Korean
Andreas II	Korean
Sabrias II	Korean
Others**	

Note: These longliners are mostly 150-200-GRT vessels
* Unconfirmed
** At least 6 other Asian longliners are believed to have been reflagged in Ecuador. Most were previously flagged in Panama.
Sources: Various

Appendix A4a.--Ecuador. Tuna purseseine fleet (ATUNEC members), 1996.*

Owners	Vessel name	GRT
Jose Agudo and Rodrigo Agudo	Alize	500
Mario de Genna and Lucia F. de Genna	Lucia T.	600
	Joselito	120
	Don Mario	600
Angel Diaz and José Diaz	Don Bartolo	600
Jorge Corral and Rafael Corral	Saturno	100
Fabricio de Genna	María	120
Carlos Vélez and Romeo Fernández	Romeo	120
Vicente Peralta and Celso Peralta	Don Quijote	350
Daniel Buehs and Bernardo Buehs Ricardo Buehs	Southern Queen	160
Javier Chopilea	Ciudad Manta	120
	Ramoncho	90
	Ugabi	1,200
Ivo Cuka	Betty Elizabeth	250
	Yelizava	600
	Betty C	700
Eusebio Reyes	Miry Ann D	600
Carlos Cevallos (Emproceánica)	Sajambre	350
	Ribadesella	350
Domingo Flores and Jorge Corral (Pesmanta)	Adriana	120

* There are various other members that are not included in the list because they are under regulatory observation.
Source: ATUNEC, information provided on February 20, 1997.

Appedix A4a.--Ecuador. Large Ecuadorean tuna vessels (over 400 GRT), 1992

Vessel	Size	
	GRT	NRT
Connie F	1,023	271
Elizabeth F	991	354
Erasno F	1,023	271
Pedro F	991	354
Manuel Ignacio F	1,023	271
Isabel Dos	984	373
Isabel Cuatro	984	373

Note: Ecuadorean fishermen also operated 50 smaller tuna boats in 1992.
Source: U.S. Embassy, Quito, April 23, 1992.

Appendix A4b.--Ecuador. Large fishing vessels registered, 1993

Country built/ Vessel name	Size	Year Built	Vessel type
	GRT		
Peru			
Erasmo F	814	1975	516
Connie F	814	1989	510
Elizabeth F	990	1983	510
Manuel Ignacio F	814	1983	510
Monte Christi	513	1978	510
Pedro F	990	1983	510
Rosa F	814	1989	510
Spain			
Isabel Cuatro	824	1974	510
Isabel Dos	824	1974	510
United States			
Victoria A	1,007	1968	510

* 500 GRT or larger
** Office of Naval Intelligence (ONI) vessel types
510 - Trawler (These vessels are probably mis-identified seiners)
516 - Tuna seiner
Source: U.S. Office of Naval Intelligence.

Appendix A4c.--Ecuador. Large* fishing vessels registered, 1996

Country built/ Vessel name	Size	Built	Vessel type***	Registration changes	
				Country	Date
	GRT	Year			
France					
Ile Aux Moines	750	1974	510	France	November 1995
Ribadesella	709	1970	510	France	August 1995
Italy					
Maria Francisca	1,280	1984	516	Mexico	July 1994
				Vanuatu	October 1995
Japan					
Halcyon No 1	589	1976	510	Liberia	April 1991
				Vanuatu	October 1993
Tatsumi	810	1979	510	Japan	July 1992
				Panama	September 1995
Peru					
Connie F	1,022	1989	510		
Elizabeth F	990	1983	510		
Erasmo F	814	1975	516		
Fiorella L	612	1977	510		
Lucia T	990	1983	510		
Manuel Ignacio F	814	1988	510		
Monte Cristi	601	1978	510		
Rosa F	814	1989	510		
Netherlands					
Don Celso	565	1974	510	Ecuador	September 1994
				Panama	December 1994
Spain					
Alize	832	1974	510	Panama	June 1993
				St. Vincent	May 1994
Isabel Dos	824	1974	510		
United States					
Gloria A	597	1970	510	United States	February 1993
Victoria A	1,007	1968	510	Panama	July 1993

* 500 GRT or larger.
** Country constructed
*** ONI vessel types
510 - Trawler (Many of these vessels are misidentified seiners and longliners.
516 - Tuna seiner
Source: U.S. Office of Naval Intelligence.

Appendix A5a1.--Ecuador. Number and tonnage of foreign vessels operating off Ecuador, 1975-92

Year	Contracts		Total	
	Association	Lease	Vessels	Tonnage
	Number		Number	NRT
1975	-	5	5	246.5
1976	-	9	9	719.8
1977	4	13	17	2,190.1
1978	3	5	8	1,783.5
1979	6	4	10	2,529.9
1980	14	1	15	3,345.9
1981	15	-	15	2,637.5
1982	11	-	11	1,853.3
1983	17	-	17	2,770.0
1984	22	-	22	4,167.0
1985	18	-	18	3,317.0
1986	20	-	20	4,118.0
1987	25	-	25	4,922.0
1988	32	-	32	6,043.0
1989	24	-	24	3,921.5
1990	20	-	20	3,132.3
1991	24	2	26	4,496.8
1992*	24	2	26	6,420.4
1993	NA	NA	NA	NA
1994	18	NA	NA	NA
1995	12	NA	NA	NA
1996	18	NA	NA	NA

Note: It is unclear if this data is compatable with the data in A5a1.
NA - Not available
NRT - Net registered tons
* Twelve vessels dedicated to squid fishing left the country after this activity was prohibited in October 1992.
Source: U.S. Embassy, Quito, September 30, 1993. Based on information furnished by Ing. Luis Torres Navarrete, Asesor Tecnico, Subsecretaría de Recursos Pesqueros, personal communications, September 24, 1993 (1975-92 data) and Orlando Crespo, Asesor del Sub-Secretario de Pesca, Dirección General de Pesca, personal communicatiins, June 7, 1976.

Appendix A5a2.--Ecuador. Foreign fleet operating in Ecuador, 1993-97*

Year	Vessels			Average size
	Number	Size		
	Number	GRT	NRT	
1993	20	9,108	4,066	455
1994	28	12,790	5,882	456
1995	31	15,104	7,036	487
1966	30	15,263	7,086	509
1997*	18	11,311	4,639	628

Note: It is unclear if this data is compatable with the data in A5a1.
* Through August 14
Source: Departamento Administración Pesquera, Subsecretaría de Recursos Pesqueros, Ministerio de Comercio Exterior, Industrialización y Pesca, personal communications, August 14, 1997.

Appendix A5b.--Ecuador. Large Ecuadorean tuna vessels (over 400 GRT), 1992

Vessel	Size	
	GRT	NRT
Connie F	1,023	271
Elizabeth F	991	354
Erasno F	1,023	271
Pedro F	991	354
Manuel Ignacio F	1,023	271
Isabel Dos	984	373
Isabel Cuatro	984	373

Note: Ecuadorean fishermen also operated 50 smaller tuna boats.
Source: U.S. Embassy, Quito, April 23, 1992.

Appendix A5c.--Ecuador. Foreign tuna vessels operating in Ecuadorean waters, 1992

Country*/ Vessel name	Type	Size	
		GRT	NRT
Japan			
Chokyu Maru 37	Longline	379	148
Hosei Maru 11	Longline	300	154
Hosei Maru 58	Longline	343	178
Hosei Maru 68	Longline	398	197
Isuzu Maru 23	Longline	284	144
Kaigata Maru 52	Longline	284	144
Nankay Maru 38	Longline	300	154
Sasano Maru 17	Longline	300	156
Sasano Maru 28	Longline	850	230
Shoei Maru 5	Longline	379	224
Shoei Maru 7	Longline	344	172
Shoei Maru 28	Longline	379	236
Taiho Maru 1	Longline	293	108
Taishin Maru 25	Longline	299	146
Tenyu Maru 8	Longline	299	150
Tenyu Maru 18	Longline	299	143
Tenyu Maru 38	Longline	379	169
Tenyu Maru 68	Longline	379	175
		6,488	3,028
Korea			
Tae Woong 502	Longline	284	144
Fae Woong 503	Longline	284	145
		568	289
Panama			
Star 101	Longline	195	86
Spain			
Isabel Cinco	Purse seine	1,065	490
United States			
Diamond Blue	Longline	98	57
Vanuatu			
El Dorado	Purse seine	417	167
Total		8,831	4,117

Source: U.S. Embassy, Quito, April 23, 1992.

Appendix B1a.--Ecuador. Fisheries catch, 1980-95

Year	Catch
	1,000 Metric tons
1980	643
1981	564
1982	665
1983	312
1984	841
1985	1,087
1986	1,003
1987	680
1988	876
1989	740
1990	391
1991	384
1992	347
1993	331
1994	340
1995	340F

F - FAO estimate
Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix B1b.--Ecuador. Estimated average annual catches of major fishery product groups

Species	Average annual catch
	Metric tons
"Pesca Blanca"/White fish*	80,000
Tuna**	90,000
Other	170,000

* Includes dorado, sharks, and other high quality white meat fish (excluding tuna).
** Includes only purseseine catch caught by members of ATUNEC.
Source: Escuela de Ciencias del Mar de la Universidad Eloy Alfaro de Manabí.

Appendix B2a.--Ecuador. Swordfish catch, 1975-95.

Year	Catch		
	FAO	INP♦	NMFS*
	Metric tons (live-weight equivalents)		
1975	-	NA	4E
1976	-	NA	8E
1977	-	NA	85E
1978	-	NA	-
1979	-	NA	-
1980	-	NA	-
1981	-	NA	-
1982	-	NA	-
1983	-	NA	-
1984	-	NA	-
1985	-	NA	12E
1986	-	NA	479E•
1987	-	NA	539E
1988	-	NA	68E
1989	-	NA	144E•
1990	352	NA	352E
1991	350	NA	361E
1992	350	NA	339E
1993	33	NA	261E
1994	Negl	525	103E
1995	Negl	504	103E
1996	NA	NA	274E

E - Estimate
NA - Not available
Note: NMFS cannot explain the wide discrepancies between different INP data sets (appendices B2a, B2b1-2, and B2c1-2).
* NMFS catch estimate based on U.S. import data
• In most years almost all of the swordish shipped to the United States was fresh. Small quantities of frozen product were noted in 1986 and 1989. This could have been fish taken by foreign longliners.
♦ This is the live-weight equivalent of the dressed (H&G) weight data provided by the INP and includes the domestic catch which the INP refers to as the "artisanal" catch. Details on the foreign associated catch, which the INP refers to as the "industrial" or commercial catch, is available in appendices B2b1-2.
♦♦ Unusually large Ecuadorean shipments were reported to the EU in 1994-95 (appendix D4). If this was product landed by domestic fishermen, then the estimate based on U.S. import data under-reports actual catches.
Source: FAO, *Yearbook of Fishery Statistics*, various years (FAO data), trade data of major importers (NMFS estimate) (appendices D2a, D3a, and D4a), and Franklin Ormaza González, Deputy Director, Instituto Nacional de Pesca, personal communications, May 30, 1996 (1992-94 data); Cecilia Marín, Biologist, Instituto Nacional de Pesca, June 3, 1997 (1989-93 data); and Dr. Mario Cobo Cedeño, Director General, Instituto Nacional de Pesca, personal communications, March 26, 1997 (1995 data).

Appendix B2b1.--Ecuador. Swordfish landings, INP, 1992-94.

Year	Catch		Total
	Foreign#	Domestic##	
	Metric tons (live-weight equivalents)*		
1992	NA	262	NA
1993	NA	265	NA
1994	NA	456	NA

Note: Discrepancies with other INP data sets are unexplained (appendices B2a, B2b2, and B2c1-2).
* Live weight equivalents calculated using a 78 percent conversion ratio from live-weight to H&G.
# Foreign vessels associated with Ecuadorean companies.
Domestic vessels are reffered to as "artisanal" in Ecuadorean statistics.
Source: Franklin Ormaza González, Deputy Director, Instituto Nacional de Pesca, personal communications, May 30, 1996.

Appendix B2b2.--Ecuador. Swordfish landings, INP, 1994-95.

Year	Catch		Total
	Foreign#	Domestic##	
	Metric tons (live-weight equivalents)*		
1989	22**		
1990	31		
1991	99		
1992	19		
1993	91		
1994	92	525	617
1995	285	504	789

* Live weight equivalents calculated using a 78 percent conversion ratio from live-weight to H&G.
** The foreign vessels were required to report their landings for the first time in 1989.
# Foreign vessels associated with Ecuadorean companies.
Domestic vessels are reffered to as "artisanal" in Ecuadorean statistics.
Source: Cecilia Marín, Biologist, Instituto Nacional de Pesca, June 3, 1997 (1989-93 data) and Mario Cobo Cedeño, Director General, Instituto Nacional de Pesca, personal communications, March 26, 1997 (1994-95 data).

Appendix B2c1.--Ecuador. Ocean pelagic landings, INP, 1994.

Year/Species	Catch		Total
	Commercial	Artisanal	
	Metric tons		
1994			
Tunas			
Yellowfin	22,577	89	22,666
Skipjack	15,284	1,855	17,139
Bigeye	6,155	141	6,296
Albacore	-	10,343	10,343
Swordfish	72	409	481
Dorado	8	14,256	14,264
Sharks*			
Blue	NA	359	359
Hammerhead	NA	335	335
Thresher	NA	2,019	2,019
Tiger	NA	3	3
Mako	NA	666	666
Smoothounds	NA	828	828
Carcharhinus sp.	NA	676	676
Subtotal	936	4,886	936**
Total	45,032	31,979	77,011

* All the shark species are included under a basket category for the commercial catch.
** This includes only the commercial catch subtotal
NA-Not available
Source: Dr. Mario Cobo Cedeño, General Director, Insituto Nacional de Pesca, personal communications, March 26, 1997.

Appendix B2c2.--Ecuador. Ocean pelagic landings, INP, 1995.

Year/ species	Catch		Total
	Commercial	Artisanal	
	Metric tons		
1995			
Tunas			
Yellowfin	15,809	43	15,852
Skipjack	30,910	2,226	33,136
Bigeye	13,576	NA	13,576+
Albacore	-	13,861	13,861
Swordfish	222	394	616
Dorado	9	11,588	11,597
Sharks*			
Blue	NA	141	141
Hammerhead	NA	201	201
Thresher	NA	1,113	1,113
Tiger	NA	NA	NA
Mako	NA	137	137
Smoothounds	NA	782	782
Carcharhinus sp.	NA	429	429
Subtotal	1,548	2,803	1,548**
Total	62,074	30,915+	92,989+

* All the shark species are included in a basket category for the commercial catch.
** This includes only the commercial catch subtotal.
+ This figure could could be higher since it is missing data.
NA-Not Available
Source: Dr. Mario Cobo Cedeño, General Director, Instituto Nacional de Pesca, personal communications, March 26, 1997.

Appendix B2d.--Ecuador. Swordfish catch estimated from foreign imports, 1975-96.

Year	Country			Total
	EU	Japan	US	
		Metric tons*		
1975	-	NA	4	4
1976	-	NA	8	8
1977	-	NA	85	85
1978	-	NA	-	-
1979	-	NA	-	-
1980	-	NA	-	-
1981	-	NA	-	-
1982	-	NA	-	-
1983	-	NA	-	-
1984	-	NA	-	-
1985	-	NA	12	12
1986	-	27	479	506
1987	-	92	539	631
1988	-	45	68	113
1989	-	63	144	207
1990	-	146	352	498
1991	-	169	361	530
1992	3	122	339	464
1993	3	101	261	365
1994	119	71	103	293#
1995	68	78	103	249
1996	NA	171	274	NA

* Live weight equivalents based on data in appendices D2a, D3a, and D4a.
Conversion ratios
European Union:
Loin conversion rate--about 65 percent:
(loins accounted for approximately 75 percent of all swordfish imports).
H&G conversion rate--about 78 percent:
(H&G accouted approximately 25 percent of all swordfish imports).
Japan: H&G conversion rate--about 78 percent
United States: H&G conversion rate--about 78 percent
Based on foreign import data. Ecuadorean observers, however, question the EU import data (appendix D4). If the shipments reported to the EU are not included, the 1994 total would only total 177 tons.
Source: Appendices D2a, D3a, and D4.

Appendix B3.--Ecuador and Peru. Turtle catch, 1985-94

Year	Catch	
	Ecuador	Peru
	Metric tons	
1985	124	36
1986	715	9
1987	-	305
1988	-	32
1989	-	79
1990	-	101
1991	-	9
1992	-	20
1993	-	4
1994	-	-

Source: FAO, *Yearbook of Fishery Statistics*, 1994.

Appendix C1.--Ecuador. Companies participating in longline fishing or marketing swordfish, 1996.

Companies	Location	Established	Activity*	Vessels** (Owned)	Vessels** (Associated)	Swordfish production
		Year		Number		Metric tons
Members of the Asociación de Exportadores de Pesca Blanca						
AGROL/Pesquera Reyes	Manta	1995	F,P,E	36	-	NA+
Bajespec	Manta	NA	E•	NA	NA	NA
DOCAPES	Manta	NA	E•	NA	NA	NA
FRESMAR	Manta	1982	F,P,E	1	10	11
FRIGOLAB San Mateo	Manta	NA	E•	NA	NA	NA
Gondi	Manta	1993	F,P,E	4	-	30
Grumodus	Manta	NA	E•	NA	NA	NA
LUBAR	Manta	1976	F,P,E	13	NA#	11
MARDELIT	Manta	NA	E•	NA	NA	NA
MARDEX	Manta	1987	F,P,E	9	-	18
Oro Marisco	Guayaquil	1991	F,P,E	1	3	25
PECIA++	Manta	NA	F,P,E	NA	NA	NA
PESYMAR	Manta	1986	F,P,E	-	1	11
Pefresman	Manta	1990	F,P,E	2	28	30
PROMAROSA	Salinas	1986	P,E	-	-	-
PEFREEXPORT	Manta	1995	P,E	-	4	9
OLIMAR	Manta	NA	F,P,E	2	-	-
Non-members						
CONSEMAR	Esmeraldas	1984	P,E	-	NA***	20
CONSEPAC	NA	NA	F	1	-	NA
ECUAFRESCO	Manta	1993	F,P,E	-	11	Negl
EMPROCEANICA	Manta	1991	F	4••	-	NA
Pesca Fresca	Manta	1991	F,P,E	4	15	Negl
Transmarina	Guayaquil	1981	F,P,E	3	6***	90
USTI	Santa Elena	NA	NA	NA	NA***	NA
Total						255+++

NA - Not available
* Activities:
E - Exporting
F - Fishing
P - Processing
** See appendix A3a for details on the company's vessels.
*** Japanese vessels
+ Pesquera Reyes sells all its swordfish catch to Gondi.
++ This company is associated with Pesca Fresca and EMPROCEANICA.
+++ This is the minimum for 1996, since catch data from many companies is unavailable.
• These companies may also be involved in fishing and processing operations.
•• EMPROCEANICA operates Pesca Fresca's four longliners.
Apparently, LUBAR is associated with various Canadian longliners.
Note: Companies located in Manta
Source: Boris Buenaventura, Executive Director, Asociación de Exportadores de Pesca Blanca (ASO-EXPEBLA), personal communications, May 15, 1996.

Country telephone code: 593
City codes:
Guayaquil: 4
Manta: 5

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Mapasingue Oeste
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Manta
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LUBAR
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Km. 3 1/2 Vía Portoviejo
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MARDELIT
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Ecuador
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MARDEX
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OLIMAR
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Pecia
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Manta
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Tel: 608-010

PEFREEXPORT
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Edificio del Banco de Pichincha
8vo Piso, Oficina 804
Manta
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PESYMAR
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Oro Marisco
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Programa de Cooperacion Tecnica para la Pesca
Comunidad Economica Europea (VECEP)
Quisquis 1502 y Tulcán Edificio Ramisa Piso N°7
Guayaquil
Ecuador
Tel: 292-402
Fax: 292-401

Source: Various

Appendix D1a.--Ecuador. Swordfish exports by destination, 1991-96

Destination	Years						
	1990	1991	1992	1993	1994	1995	1996
	Metric tons						
United States	274	282	265	203	80	80	214
Japan*	114	132	95	79	55	61	133
European Union	NA	-	2	2	81	46	NA
Others**	NA	NA	NA	NA	NA	NA	NA
Total	NA	414	362	284	216	187	NA

* Estimated swordfish portion of billfish shipments
** Swordfish shipments to other countries are believed to be non-existent or negligible
Source: Various

Appendix D1b.--Ecuador. Swordfish export prices, 1993-95

Commodity/ destination	Apparent price			
	1993	1994	1995	1996
	(US$/Kg)			
Fresh				
United States	2.71	3.38	4.34	5.00
Japan*	NA	NA	NA	
European Union	9.28	11.90	NA	NA
Frozen				
United States	NA	11.22	NA	2.86
Japan*	3.49	7.09	4.68	
European Union	NA	3.63	3.72	NA

* The Japanese apparent prices shown refer to both marlin and swordfish, since the Japanes combine these species under the same import category.
Currency exchange rates:
EU:
1993= 1.16 $/ECU 0.86 ECU/$
1994= 1.19 $/ECU 0.84 ECU/$
1995= 1.30 $/ECU 0.77 ECU/$
Source: Various

Appendix D2a.--United States. Swordfish imports from Ecuador, 1980-96

Year	Commodity		Total
	Fresh	Frozen	
	Metric tons		
1975	NA	NA	3.3
1976	NA	NA	6.3
1977	NA	NA	66.5
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985	9.7	-	9.7
1986	363.5	10.4	373.9
1987	419.8	0.3	420.1
1988	53.0	-	53.0
1989	94.5	17.5	112.0
1990	274.3	-	274.3
1991	281.7	-	281.7
1992	263.0	1.5	264.5
1993	203.3	-	203.3
1994	79.6	0.1	79.7
1995	80.2	-	80.2
1996	213.1	0.7	213.8

Source: U.S. Bureau of the Census

Appendix D2b.--United States. Swordfish imports from Ecuador, 1975-96

Year	Commodity		Total
	Fresh	Frozen	
	U.S.$1,000		
1975	NA	NA	7
1976	NA	NA	13
1977	NA	NA	79
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	-	-	-
1984	-	-	-
1985	27	-	27
1986	1,469	36	1,505
1987	1,259	2	1,261
1988	158	-	158
1989	430	63	493
1990	1,149	-	1,149
1991	924	-	924
1992	700	7	707
1993	551	-	551
1994	269	1	270
1995	348	-	348
1996	1,069	2	1,071

Source: U.S. Bureau of the Census

Appendix D2c1.--United States. Apparent prices of fresh swordfish imports from Ecuador, 1980-96

Year	Imports		Apparent price
	Quantity	Value	
	Metric tons	US$1,000	US$/kg
1985	9.7	27	2.78
1986	363.5	1,469	4.04
1987	419.8	1,259	3.00
1988	53.0	158	2.98
1989	94.5	430	4.55
1990	274.3	1,149	4.19
1991	281.7	924	3.28
1992	263.0	700	2.66
1993	203.3	551	2.71
1994	79.6	269	3.38
1995	80.2	348	4.34
1996	213.8	1,071	5.00

Source: U.S. Bureau of the Census

Appendix D2c2.--United States. Apparent prices of frozen swordfish imports from Ecuador, 1980-96

Year	Imports		Apparent price
	Quantity	Value	
	Metric tons	US$1,000	US$/kg
1985	-	-	-
1986	10.4	36	3.46
1987	0.3	2	6.67
1988	-	-	-
1989	17.5	63	3.60
1990	-	-	-
1991	-	-	-
1992	1.5	7	4.67
1993	-	-	-
1994	0.1	1	11.22
1995	-	-	-
1996	0.7	2	2.86

Source: U.S. Bureau of the Census

Appendix D2d.--United States. Swordfish imports from Ecuador by Customs District, 1994-96

Commodity/ Customs district	1994			1995			1996		
	Value	Quantity	Price*	Value	Quantity	Price*	Value	Quantity	Price*
	US$1,000	M. tons	US$/kg	US$1,000	M. tons	US$/kg	US$1,000	M. tons	US$/kg
Fresh									
Baltimore	3.4	0.4	9.59	-	-	-	-	-	-
Los Angeles	-	-	-	1.4	0.2	7.92	-	-	-
Miami	84.9	26.7	3.18	230.7	51.7	4.46	922.0	185.8	4.96
New York	180.9	52.6	3.44	115.6	28.4	4.07	146.5	27.3	5.36
Subtotal**	269.1	79.6	3.38	347.7	80.2	4.33	1,068.5	213.1	5.01
Frozen									
Baltimore	1.4	0.1	11.22	-	-	-	-	-	-
Miami	-	-	-	-	-	-	1.9	0.7	2.71
Subtotal**	1.4	0.1	11.22	-	-	-	1.9	0.7	2.71

* Apparent prices derived from dividing the total import value by quantity.
** Totals may not agree due to rounding.
Source: U.S. Bureau of the Census.

Appendix D2e.--United States. Tuna imports, 1990-96

Product form/ species	Year						
	1990	1991	1992	1993	1994	1995	1996
				US$ 1,000			
Fresh							
Albacore	1,765	2,785	3,993	1,659	1,531	1,195	247
Bluefin	2	-	-	3	5	9	-
Skipjack	-	-	-	-	2	-	-
Yellowfin	64	281	109	89	412	300	1,248
Unspecified	960	1,563	7,273	6,354	22,254	28,499	30,344
Subtotal	2,791	4,629	11,375	8,105	24,204	30,003	31,839
Frozen							
Albacore	44	7	10	3	65	-	52
Bluefin	-	4	-	-	-	-	-
Skipjack	4,615	1,927	645	84	191	1,523	2,504
Yellowfin, eviscerated	9	16	17	-	-	7	-
Yellowfin, whole	3,405	2,701	275	454	1,360	832	905
Unspecified							
Loins (>6.8 kg)	5,408	6,060	3,395	13,885	20,483	40,738	59,148
Loins (<6.8 kg)	-	122	-	-	166	218	4
Other	157	96	137	132	614	15	780
Subtotal	13,638	10,933	4,479	14,558	22,879	43,333	63,393
Canned							
Albacore (Not in oil not > 7 kg)	-	56	-	3	39	-	144
Unspecified							
In oil	-	-	-	-	1	-	-
Not in oil (not>7 kg)	1,721	561	28	4,707	2,038	369	523
Not in oil (not>7 kg in quota)	1,268	1,637	-	199	1,192	369	185
Total*	19,418	17,816	15,882	27,572	50,353	74,074	96,084

* Totals may not agree due to rounding.
Source: U.S. Bureau of the Census.

Appendix D2f.--United States. Fishery imports from Ecuador, by product form, 1990-1996

Product form	Year						
	1990	1991	1992	1993	1994	1995	1996
				US$ Million			
Live	-	-	Negl	Negl	Negl	-	-
Fresh	22.0	28.6	35.5	31.4	44.6	52.1	56.2
Frozen	291.2	357.5	370.7	358.9	456.3	459.7	379.9
Canned	6.6	4.9	0.8	6.3	5.0	2.3	2.9
Cured	-	Negl	-	-	Negl	Negl	Negl
Other	20.6	19.9	17.0	31.5	30.4	42.9	60.2
Total	340.4	410.9	424.0	428.1	536.3	557.0	499.2

Source: US Census of Bureau

Appendix D2g.--United States. Fresh imports of oceanic pelagics from Ecuador, 1990-1996.

Species/ form	Year						
	1990	1991	1992	1993	1994	1995	1996
				US$ 1,000			
Shark							
Dogfish	861.7	1,048.7	932.2	527.6	1,307.6	32.3	-
Other	-	-	-	-	-	1,344.0	1,978.7
Subtotal	861.7	1,048.7	932.2	527.6	1,307.6	1,376.3	1,978.7
Swordfish	1,149.0	924.3	700.0	550.5	269.1	347.7	1,068.5
Tuna							
Albacore	1,765.8	2,785.4	3,993.4	1,658.5	1,531.4	1,194.6	247.2
Yellowfin	64.4	280.5	109.3	89.4	411.6	299.6	1,248.2
Skipjack	-	-	-	-	2.3	-	-
Bluefin	2.2	-	-	3.3	4.9	9.0	-
Other	959.5	1,562.9	7,272.6	6,353.6	22,253.7	28,498.8	30,343.5
Subtotal	2,791.9	4,628.8	11,375.3	8,104.8	24,203.9	30,002.0	31,838.9
Total	4,802.6	6,601.8	13,007.5	9,182.9	25,780.6	31,726.0	34,886.1

Source: US Census of Bureau

Appendix D2h1.--United States. Fresh swordfish imports from Ecuador, by month, 1993-97

Month	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
				Metric tons				
January	12.0	17.6	47.7	21.4	11.1	2.2	8.8	23.3
February	5.9	3.3	2.7	24.5	10.2	4.4	23.9	30.2*
March	12.3	13.0	38.6	36.8	5.4	3.5	3.5	17.0*
April	16.5	32.5	21.0	17.7	5 6	7.9	6.2	16.1
May	14.4	27.9	13.1	10.9	0.7	7.0	5.5	20.1*
June	8.6	24.8	10.2	13.7	10.8	9.4	12.7	24.5*
July	44.5	44.7	20.5	12.0	11.8	6.0	21.1	38.9
August	57.9	25.9	30.2	15.5	7.1	10.5	25.5	
September	12.3	36.9	11.6	18.7	3.4	7.7	32.3	
October	21.5	31.6	18.3	5.4	4.8	5.7	21.1	
November	23.0	15.5	22.5	10.7	4.7	8.0	21.8	
December	45.4	7.9	26.6	15.8	3.9	8.0	30.9	
Total**	274.3	281.7	263.0	203.3	79.7	80.2	213.8	

* Totals may not add up due to rounding.
** Includes small quanties of processed product (steaks)
Source: Bureau of the Census

Appendix D2h2.--United States. Fresh swordfish imports from Ecuador, by month, 1993-97

Month	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
	Percentages							
January	4.4	6.3	18.1	10.5	14.0	2.7	4.1	
February	2.2	1.2	1.0	12.0	12.8	5.5	11.2	
March	4.5	4.6	14.7	18.1	6.8	4.4	1.6	
April	6.0	11.5	8.0	8.7	7.0	9.9	2.9	
May	5.3	9.9	5.0	5.4	0.9	8.7	2.6	
June	3.1	8.8	3.9	6.7	13.6	11.7	5.9	
July	16.2	15.9	7.8	5.9	14.8	7.5	9.9	
August	21.1	9.2	11.5	7.6	8.9	13.1	11.9	
September	4.5	13.1	4.4	9.2	4.3	9.6	15.1	
October	7.8	11.2	7.0	2.7	6.0	7.1	9.9	
November	8.4	5.5	8.6	5.3	5.9	10.0	10.2	
December	16.6	2.8	10.1	7.8	4.9	10.0	14.5	
Total*	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

* Totals may not add up to 100.0 due to rounding.
Source: Bureau of the Census

Appendix D3a.--Japan. Swordfish and marlin imports from Ecuador, 1986-96

Year	Quantity		Total
	Billfish	Swordfish	
	Metric tons		
1986	43E	21E	64
1987	145E	72E	217
1988	71E	35E	106
1989	97E	49E	146
1990	227E	114E	341
1991	263E	132E	395
1992	191E	95E	286
1993	157E	79E	236
1994	109E	55E	164
1995	125E	62E	187
1996	265E	133E	398

E - Estimated billfish and swordfish proportion of the Japanese basket billfish/swordfish import category. The authors stress that this is a very rough estimate based upon the minimal data available.
Source: Japan Tariff Association, *Japan Exports & Imports*, various years.

Appendix E3b.--Japan. Billfish (including swordfish) imports from Ecuador, 1986-96.

Year	Product form			Total*
	Fresh	Frozen		
		Fillets**	Other	
	Metric tons			
1986	-	5	59	64
1987	-	16	201	217
1988	-	29	77	106
1989	-	14	132	146
1990	-	17	324	341
1991	Negl	35	360	395
1992	-	22	264	286
1993	-	11	225	236
1994	-	19	145	164
1995	-	54	133	187
1996	-	60	338	398

* Totals may not agree due to rounding
** Until 1993 the fillets category included some tuna fillets
Source: Japan Tariff Association, *Japan Exports & Imports*, various years.

Appendix D4.--European Union. Swordfish imports from Ecuador, 1991-94

Country	Commodity	Year				
		1991	1992	1993	1994	1995
		Metric tons				
Germany	Fresh	-	2	2	1	Negl
	Frozen	-	-	-	-	1
	Frozen Fillets	-	-	-	-	4
	Frozen Meats	-	Negl	-	-	-
Italy	Frozen	-	-	-	42	5
Netherlands	Frozen	-	-	-	38	48
U.K.	Fresh	-	-	-	-	Negl
Total		-	2	2	81	58

Source: EU. Eurostat.

Appendix D5a.--Ecuador. Oceanic pelagic (except tuna) exports, 1991-1995.

Year/ Species	Total*		Commodity															
			Fresh								Frozen							
			Subtotal		H&G		Fillets		Trozo		Subtotal		Gutted		H&G		Fillets	
	MT	$1,000	MT	$1,000	MT	$1,000	MT	$1,000	MT	$1,000	MT	$1,000	MT	$1,000	MT	$1,000	MT	$1,000
1991																		
Dorado	5,349	13,525	3,905	10,604	3,799	10,255	101	335	4	13	1,144	2,920	20	38	66	121	1,356	2,760
Swordfish	348	2,220	343	2,210	340	2,191	2	19	-	-	5	10	5	10	-	-	-	-
Sailfish	1	1	1	1	Negl	Negl	Negl	Negl	-	-	-	-	-	-	-	-	-	-
Marlin	1,049	2,436	463	1,378	281	727	106	401	74	249	586	1,057	522	939	63	118	-	-
Blue shark	641	897	211	513	210	510	1	2	-	-	429	384	353	272	47	38	27	73
Thresher*	1,705	3,221	1,611	3,100	1,606	3,090	5	10	-	-	93	121	23	31	56	53	14	37
1992																		
Dorado	5,693	16,955	4,076	13,740	3,806	12,718	270	1,022	-	-	1,617	3,215	-	-	134	214	1,482	3,000
Swordfish	162	1,140	162	1,140	150	1,039	11	100	-	-	1	1	1	1	-	-	-	-
Sailfish	1	4	1	4	1	4	-	-	-	-	-	-	-	-	-	-	-	-
Marlin	771	1,856	284	1,028	102	316	165	660	16	50	486	827	482	821	4	6	-	-
Blue shark	557	922	193	518	192	515	1	3	-	-	364	403	315	338	48	65	Negl	Negl
Thresher	1,286	2,634	1,244	2,526	1,244	2,525	Negl	1	-	-	41	108	-	-	6	11	35	96
1993																		
Dorado	5,137	18,027	3,986	14,630	3,497	12,780	400	1,849	-	-	1,240	3,396	70	140	181	436	987	2,820
Swordfish	229	1,262	134	1,016	131	989	3	27	-	-	95	246	95	246	-	-	-	-
Sailfish	1	4	1	4	1	3	Negl	1	-	-	-	-	-	-	-	-	-	-
Marlin	872	2,317	428	1,546	110	353	313	1,173	5	19	443	771	405	704	6	11	32	55
Blue shark	745	1,138	262	733	259	723	2	9	-	-	483	405	349	212	40	40	94	153
Thresher	1,635	3,848	1,574	3,752	1,573	3,751	Negl	1	-	-	61	96	36	31	8	15	17	49
1994																		
Dorado	5,436	19,483	3,021	11,224	2,707	9,684	313	1,539	-	-	2,414	8,259	4	6	173	442	2,237	7,810
Swordfish	251	1,533	168	1,261	165	1,239	3	22	-	-	83	272	70	181	2	4	10	86
Sailfish	Negl	Negl	-	-	-	-	-	-	-	-	Negl	Negl	Negl	Negl	-	-	-	-
Marlin	649	1,873	322	1,217	133	446	189	771	-	-	326	1	280	478	13	31	32	146
Blue shark	887	1,534	357	1,026	356	1,023	1	2	-	-	529	1	489	395	13	22	27	91
Thresher	1,328	3,059	1,300	3,037	1,290	3,008	10	29	-	-	27	22	27	22	-	-	-	-
1995																		
Dorado	6,082	21,137	3,155	10,904	2,956	9,844	198	1,060	-	-	2,927	10,232	5	15	107	322	2,813	9,894
Swordfish	235	1,479	172	1,317	170	1,302	1	15	-	-	63	161	29	68	31	85	2	7
Sailfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marlin	677	1,706	171	708	62	241	98	425	10	41	505	998	462	794	1	1	42	202
Blue shark	846	1,328	255	761	254	759	1	1	-	-	590	567	298	229	274	280	17	56
Thresher	706	1,751	622	1,605	620	1,602	1	3	-	-	84	146	53	81	13	8	17	56

* Totals may not add up due to rounding
** Thresher shark
Source: Facturas Comerciales y Conocimientos de Embarques (MICIP), various years.

Appendix D5b.--Ecuador. Export products available from selected ASO-EXPEBLA companies

Species	Season	Product
Dorado*	December-April	Fresh H/G, Frozen fillets
Marlin, blue	May-December	Fresh H/G, Loins
Sharks		
Mako	Year round	Fresh H/G, Frozen
Thresher	Year round	Fresh H/G, Frozen
Swordfish	May-December	Fresh H/G
Tuna, bigeye	May-December	Fresh H/G

* Mahi-mahi
Source: Boris Buenaventura, Executive Director, Asociación de Exportadores de Pesca Blanca (ASO-EXPEBLA), personal communications, May 15, 1996.

Appendix E.--Ecuador. Common, English and Scientific names of major species caught with longlines.

Common Name (Ecuador)	English	Scientific
Atun		
Albacora*/aleta amarilla	Yellowfin tuna	Thunnus albacares
Bonito barrilete	Skipjack tuna	Katsuwonus pelamis
Ojo grande	Bigeye tuna	Thunnus obesus
Bonito pata seca	Black skipjack	Euthynnus lineatus
Corvina de Roca	Pink brotula	Brotula clarkae
Corvina plateada	Seatrout spp.	Cynoscion spp.
Colorado	Gulfconey seabass	Epinephelus acanthistius
Dorado	Dorado (Mahi Mahi)	Coryphaena hippurus
Huayaipe	Amberjack	Seriola spp.
Congrio	Kingclip	Genypterus spp.
Meros	Groupers	Serranidae
Pargos	Snappers	Lutjanidae
Perela	Southern rock seabass	Paralabrax callaensis
Pez de Gallo (gallo)	Roosterfish	Nematistius pectoralis
Pez espada	Swordfish	Xiphias gladius
Picudos		
Picudo (marlin) azul	Indo-Pacific blue marlin	Makaira mazara
Picudo banderón/pez vela	Pacific sailfish	Istiophorus platypterus
Picudo (marlin) gacho	Striped marlin	Tetrapturus audax
Picudo (marlin) negro	Black marlin	Makaira indica
Sierra	Wahoo	Acanthocybium solandri
Tiburones		
Azul	Blue shark	Prionace glauca
Aleta negra	Blacktip shark	Carcharhinus limbatus
Cazón	Galapagos shark	C. galapagensis
Cazón	Whitenose shark	C. velox
Cazón	Pacific sharpnose shark	Rhizoprionodon longurio
Cuero duro	Smalltail shark	Carcharhinus porosus
Martillo (cachona)	Scalloped hammerhead	Sphyrna lewini
Martillo	Great hammerhead	S. makarran
Martillo	Bonnethead	S. tiburo
Martillo	Smooth hammerhead	S. zygaena
Rabón zorro	Thresher shark	Alopias spp.
Tigre	Tiger shark	Galeocerdo cuvieri
Tinto/mako	Mako shark	Isurus oxyrinchus
Toro (ñato)	Bull shark	Carcharhinus leucas
Tollo pata negra	Carcharhinus sp.	C. sp.
Tollo (cazón de leche)	Sicklefin smoothhound	Mustelus lunulatus

* Some locals use the name albacora to identify the bigeye tuna.
Source: Various

1.3

PERU

Peruvian fishermen have conducted one of the largest swordfish fisheries in Latin America. Historical catch data is limited, but available information suggests catches in 1950 of about 2,500 tons and some estimates are substantially higher, nearly 7,000 tons. Most of this huge catch was taken off the northern coast. As the fishery was conducted with harpoons, it involved an enormous effort by artisanal fishermen. The Peruvian harpoon fishery has since ended and during the 1990s only minimal quantities of swordfish have been harvested incidentally by Peruvian fishermen. It is unclear why the Peruvian swordfish fishery declined. It does not appear to have been primarily a resource problem, but rather a diversion of effort. The changing economics of harpoon fishing and the allure of more attractive alternate job opportunities for the artisanal fishermen in the booming anchovy fishmeal and mining industries may explain the reduced harpoon effort. Shifts in abundance and distribution, to which the artisanal fishermen in their small boats with limited range could not adjust, could also have been involved. Such shifts could have been caused by a variety of factors, such as possible climatic changes or massive harvests of fodder species. Some Peruvian specialists, however, do not believe the massive shifts in anchovy abundance have affected swordfish. Peru has not developed a substantial longline or driftnet fleet to target oceanic pelagics such as swordfish or tuna, as has been done in Chile and Ecuador. Peruvian fishermen have deployed few commercial longliners during the 1990s, but with little success. Some of the companies involved had difficulties managing unfamiliar commercial longline operations. Other companies point to Government policies which they claim impaired operations. Peru implemented a tuna management plan in 1994, but few companies have since successfully initiated tuna or swordfish longline operations. Artisanal and small-scale commercial longline fishermen do target sharks and dorado in coastal waters. Notably shark catches have fallen to extremely low levels in the early 1990s. Limited Peruvian construction and high tariffs restricting vessel imports has impeded the development of a domestic longline fishery. Peru has conducted little research on oceanic pelagics including tunas. No research has been conducted specifically on swordfish. Some companies have attempted to catch and export high-quality tunas, swordfish, and other oceanic pelagics. These efforts, however, have had little success. Shipments are still very small and trends erratic. Despite the difficulties experienced, Peruvian companies continue efforts to develop longline fisheries. One company (Pesquera Atlantis) is operating commercial longliners. One of Peru's most important fishing companies (Sindicato Pesquero) has deployed three small longliners for swordfish in 1997 and has targeted swordfish with some success. Another smaller company (Pesquera Eraz) has begun targeting swordfish with its coastal longliner in 1997. The onset of an El Niño event in 1997 is stimulating increased interest as increased billfish catches are being reported in coastal waters, even by artisanal fishermen in small boats. Peru reported small exports of swordfish during the 1990s, generally ranging from 0-31 tons, with the exception of 1992 when 155 tons was exported to the European Union. The source of the unusually large 1992 swordfish shipments is unclear, but was probably not harvested by domestic Peruvian fishermen. In contrast to the difficulties experienced by Peruvian fishermen, foreign fishermen continue to catch swordfish off Peru. The foreign fishing is conducted primarily off the southern coast, both inside and outside the 200-mile limit. The Japanese and Spanish are the most active. The Japanese primarily target tuna and have obtained some Peruvian fishing licenses. The Spanish target swordfish and theoretically operate outside the 200-mile limit, but they transship their catch through Peruvian ports. It is unclear why Peruvian companies are having so much difficulty initiating a commercial longline fishery. A substantial resource is clearly available as foreign distant-water longline fishermen have been successfully fishing oceanic pelagics off Peru for years. Neighboring Chile and Ecuador also have successful longline operations. Peruvian fishing companies have considerable experience and managerial capabilities. They conduct some of the largest fishing operations in Latin America. It may be that fishermen who are used to easily taking tons of fish in easily accessible coastal grounds are apparently finding it difficult to shift to much more demanding fisheries in which only small quantities of fish may be landed, even though the economic returns may be greater in the long run. Other factors include the investments need to build longline vessels, the availability of other species requiring smaller investments and less advanced technology, and a costly regulatory regime.

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I. Industry Overview

Peru has only a brief history of commercial fisheries, despite the massive harvest the country's fishermen now report. Fishermen as recently as the 1930s reported only negligible artisanal catches to supply a small domestic market. From such primitive beginnings in the 1930s, Peruvian fishermen have built one of the world's largest fishing industries. The country's fishermen by the 1960s were harvesting massive amounts of anchovy and other small pelagics to produce fishmeal and oil. Fishermen set world records, making Peru the leading fishing country in several years. Few other countries, however, focused their fishing industry so narrowly on one species and commodity. Peru's fishing industry has undergone tumultuous shifts during its brief history. Fishermen have been buffeted by powerful climatic changes and periodic El Niño events which have had massive impacts on fish populations and distribution. In addition, domestic political differences over the role of the Government in fisheries has discouraged investors and, as a result, the development of the industry. Few investors are willing to commit significant capital if they believe that the Government in a few years or even months will radically change the regulatory structure. The Government and private industry have attempted to diversify the industry away from the dependence on anchovy. Despite Government efforts and numerous private initiatives to diversify, Peru's fishing industry today remains largely dependent on the anchovy fishery and the fishmeal reduction industry. Catches during the 1990s have approached record levels and officials are worried about the increasing fleet capacity and rising effort. Industry observers are worried about

***Photo 1.**--Peru's first commercial fishery was for bonito. A sizeable canning industry developed during the late 1930s to supply both domestic and export markets. Milton Linder*

the warming water temperatures in 1997 and possible impact on the key anchovy stock. Important resources such as oceanic pelagics are still not being significantly utilized by the country's domestic fishermen.

A. Overall industry

The first important commercial fishery developments in Peru occurred during the late 1930s and early 1940s when fishermen began landing large quantities of bonito (photo 1). World War II provided a significant impetus to the industry's development. Peruvian investors began to take advantage of the abundance of fish off Peru at the same time that World War II increased the demand for vitamin A and D in the United States. Bonito livers were an excellent source of these vitamins. At first the carcasses were discarded, but a small canning industry soon developed in an effort to utilize the carcasses. The canneries exported the bonito to the United States as canned tuna. The War created an enormous demand for canned food products in the United States and other combatant countries. Bonito exports declined after the war in the late 1940s as U.S. domestic tuna production increased and the U.S. Food and Drug Administration (FDA) ruled that the bonito could not be labeled as tuna. As the Peruvian canning industry developed, some canneries had begun using the bonito scraps to produce a low-quality meal and occasionally used anchovy and other species for raw material.

A Peruvian-United States joint venture built the first fishmeal plant dedicated to anchovy in 1950. Throughout the 1950s, fishermen acquired vessels to supply a growing number of fishmeal plants (photo 2). Peru by the late 1950s was beginning to land and process very substantial quantities of anchovy and by the 1960s had developed a major fishmeal industry.[1] Small pelagic catches to supply fishmeal plants reached enormous quantities, exceeding the catch levels of the major traditional fishing countries. The country's fishermen during the early 1970s landed nearly 13 million metric tons (t) (appendix B1 and photo 3), most of which was anchovy that was reduced to fishmeal and oil. Peru became the world's largest producer and exporter.

The massive fishing effort, based primarily on anchovy, combined with an especially severe El Niño event and a resulting recruitment failure caused the anchovy stock to crash in 1972. The Peruvian catch fell from 12.7 million t in 1970 to a mere 2.3 million t in 1973 (appendix B1 and figure 1). As a result of this precipitous decline, almost entirely in the anchovy catch, the production of fishmeal and oil plummeted. This was the largest decline any country has ever experienced in its fisheries catch and production. The resulting crisis in the fishing industry induced Peru's left-wing military government in 1973 to nationalize much of the floundering fishing industry. The Government assumed responsibility for a huge seiner fleet and large number of reduction plants, as well as the employment of the crews and workers. A state fishmeal company, the Empresa Nacional Pesquera (PESCA-PERU), was created to oversee the nationalized assets. Many seiners and plants, however, were idled because of the severe raw material (anchovy) shortage (photo 4). Thus the government found itself forced to pay the salaries of thousands of inactive crews and plant workers and maintain a huge network of plants, many closed or working only occasionally because of the shortage of raw material.

Peruvian military and civilian governments for the next 20 years made extensive, costly efforts to manage the country's mammoth fishmeal industry (photo 5). These efforts, however, were largely unsuccessful in returning the industry to profitable operation. Financing deficits amassed by state fishing companies required substantial annual Government allocations.[2] Rather than generating revenue, many state companies required massive appropriations to subsidize continuing operations. the state companies that did not run deficits, however generally

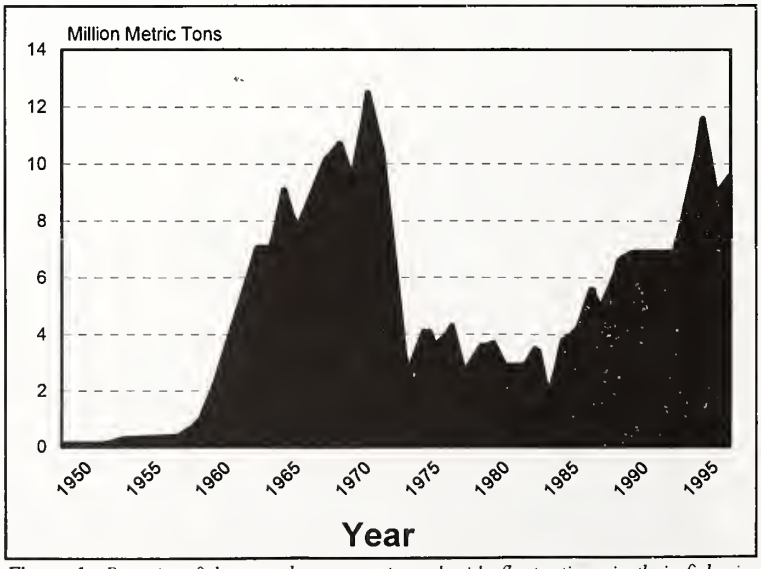


***Figure 1.**--Peruvian fisherman have experienced wide fluctuations in their fisheries catch. Catches during the mid-1990's are approaching the record level set in 1970.*

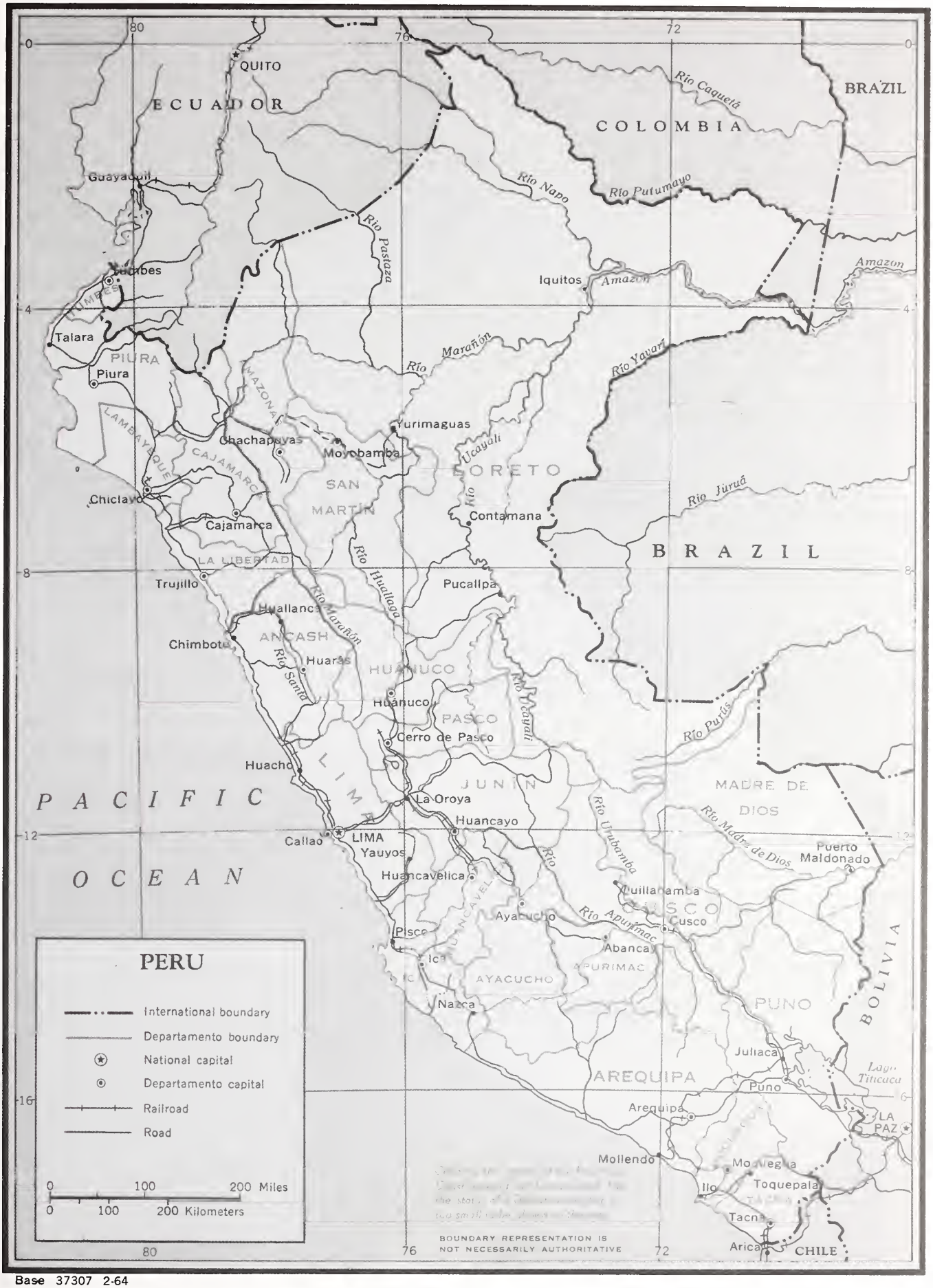


Figure 2.--Map of Peru.

Photo 2.--Peru during the 1960s built a massive fleet of small seiners ("bolicheras") to harvest anchovy for reduction to fishmeal. S. Lerrein (FAO)

Photo 3.--Peruvian fishermen landed massive quantities of anchovy during the 1960s. Fishermen were easily able to fill their holds during short trips. R. Coral

Photo 4.--After nationalizing the fishing industry in 1973, a military government assumed responsibility for large numbers of idled fishermen and plant workers. D. Weidner

produced little income for the Government and no tax revenue as they were state entities. In effect, the Government was taxing profitable, efficient private operations to support inefficient state operations. In addition, Government policies to support the state companies, especially PESCA-PERU, impaired the operations of the more efficient private companies which during the 1970s and 1980s continued to produce canned and frozen products. Fishery catches fluctuated widely during the 1970s and 1980s, primarily because of climatic factors and the lingering effect of over fishing in the 1960s and early 1970s (appendix B1 and photo 6). These enormous annual catch fluctuations severely affected the operating results of both state and private fishing companies. The financial burden of subsidizing the deficit-plagued state fishing companies finally proved unsustainable for financially strapped Peruvian Governments and efforts were initiated to reduce the burden.

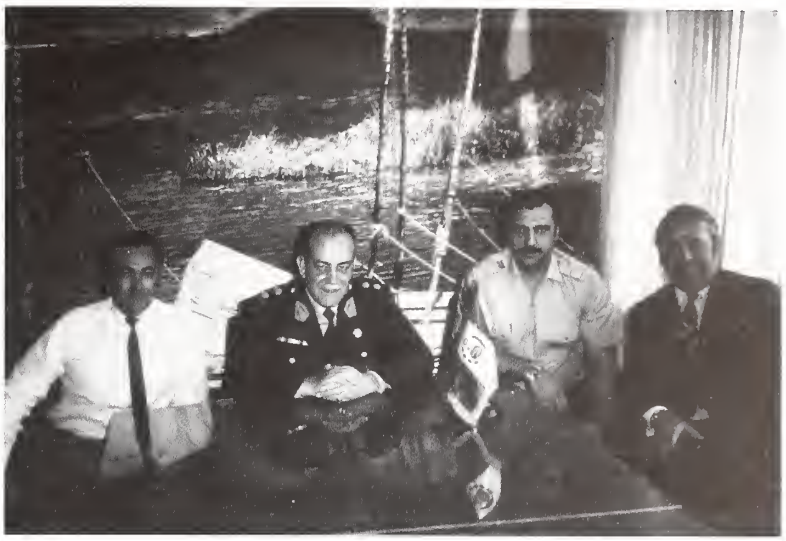


***Photo 5**--Peru's massive fishmeal industry was for nearly 20 years run by a military government. The industry, as a result, developed very differently then in neighboring Chile. D. Weidner*

Successive Administration's gradually managed to pare back the state role in the fishing industry during the late 1970s and early 80s. First the fleet was re-privatized. This was accomplished with relatively little controversy in 1976. The second Belleunde Administration in 1980 began closing surplus fishmeal plants and laying off workers. In contrast to the fleet privatization, efforts to rationalize the fishmeal plants gave rise to a great deal of controversy. The social cost was significant and the re-privatization policies resulted in sharp criticism of the Administration's policies. Populist politicians criticized Administration efforts to privatize a multitude of state enterprises, including those in the fisheries sector. These and other economic austerity measures, played an important role in the election of the populist Aprista Party in 1985.

The Aprista Administration, following a philosophical commitment to state involvement in the productive sector, reversed the privatization policies of previous administrations. The Administration made another effort to expand the government role in the economy, including fisheries. Some Aprista officials appeared openly hostile to private companies and some press reports described APRA as having "declared war" on private fishing companies.[3] The new Aprista Administration initiated a further series of costly, but even less successful, efforts to support state-owned fishing companies. The results were another series of financial disasters. Some of these efforts such as the attempt to develop a state tuna fleet through Peruana de Pesca (PEPESCA), a state fishing company labeled by the previous administration as an "elefante blanco," resulted in massive deficits.[4]

***Photo 6**--The large anchovy catch reported during the 1950s plummeted after the 1972 El Niño. Milton Linder*

The current Fujimori Administration has taken several major fishery initiatives. The Administration renewed the privatization process with increased vigor and has succeeded in again sharply reducing the state role.[5] It is in the process of selling the remaining assets of

PESCA-PERU and other state-owned fishing companies. Assets sales have grossed the Government over $100 million through 1996.[6] The World Bank has provided assistance in the privatization process. Most PESCA-PERU plants have been sold, but the Government is reporting difficulties selling the remaining assets.[7] Bids were let on five remaining PESCA-PERU plants in May 1997, but only two attracted bidders.[8] Further auctions have been held at gradually lower base prices.[9] The Fujimori Administration has also streamlined the country's patchwork body of fisheries legislation composed of several decades of unrelated and sometimes contradictory fishery laws and regulations. The Government enacted a new general fisheries law in 1992 and subsequently issued implementing regulations. One of the primary goals was to encourage the private sector and attract both domestic and foreign investment. In the process, opportunities have been created in areas previously reserved for state-owned companies.[10] Another primary goal has been to develop a modern fisheries management system ensuring sustainable development. (See "Fisheries Agency and Policies".)

Peruvian fishing companies in recent years have benefitted from the best catches in years. The 1994 catch exceeded 11.6 million t, approaching the record levels of the late 1960s and early 1970s (appendix B1 and figure 1). Many observers are concerned, however, about the sustainability of the massive fishing effort currently under way. One long-time Peruvian specialist warns that the biomass was greater during the early 1970s before the 1972 crash than it was in late 1995.[11] This suggests that significant future catch declines are possible. The 1995 catch, in fact, declined sharply, but still totaled over 8.9 million tons (appendix B1 and figure 1). Peruvian observers reported in 1996 that catches continued at high levels, running well in excess of Government-imposed catch quotas. Government officials are concerned by the steadily expanding fleet and have been studying possible management options.[12] Preliminary reports suggest a 1996 catch of about 9.6 million tons. Fishing companies are, however, very concerned about the warming water temperatures in 1997. Some observers are projecting a strong 1997-98 El Niño event and substantial Peruvian and Chilean catch declines in 1997-98.[13]

Private companies during the 1990s are making major investments in the fishing industry, purchasing new vessels and expanding processing facilities (photo 7). Peru's fishing industry is still largely dependent on the production of fishmeal from anchovy and other small pelagic fisheries, but many companies are attempting to expand production of fresh, frozen, and canned commodities for direct human consumption.[14] Most observers, however, believe that Peru is still not fully utilizing many available resources. The Peruvian fishing industry continues to focus on a relatively small number of species such as anchovy, hake, jack mackerel, sardines, and a few others. The fishmeal sector continues to be the most profitable sector of the industry.[15] One industry observer, for example, contends that of the 712 species occurring off Peru, the industry is only significantly utilizing 16 species.[16] Swordfish may well be one of those species.

Peruvian companies are reporting significant increases in fishery exports. Shipments have expanded substantially from the-mid 1980s. Exporters shipped only about $220 million worth of fishery products during 1985, but increased shipments to $685 million in 1993 and a record $980 million in 1994, before declining in 1995 (appendix E1 and figure 3). Shipments are still dominated by the key trade in fishmeal and oil. Edible products were only 11-13 percent of exports during the early 1990s, although the absolute value of these shipments rose from less than $50 million in 1990 to nearly $90 million in 1993. Edible shipments increased sharply in 1994 to 17 percent of fishery exports valued at almost $170

***Photo 7.**--Many new seiners and some trawlers were added to the fleet during the 1990s. Some investors declined to register their vessels in Peru because of tax regulations.*

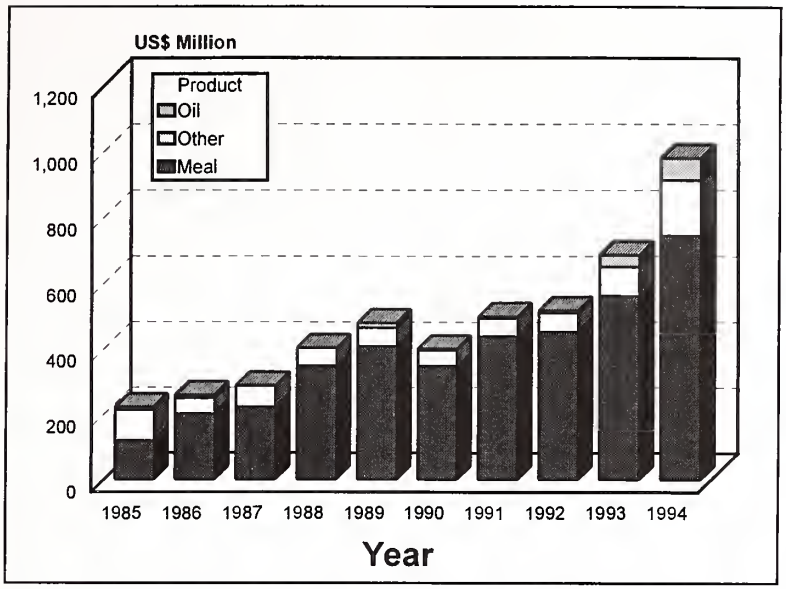


Figure 3.--Peruvian exports approached $1 billion in 1994, but the great bulk of shipments are still fishmeal and oil.

million. The 1994 results represent a significant expansion of the edible fisheries sector, but the long-term trends are still unclear. Edible shipments, for example, declined in 1995. Peruvian shipments to the United States are mostly edible product, primarily frozen (appendix E2c and figure 4). After peaking in 1995 at $53 million declined to less than $40 million in 1996 (appendix E2b).

B. Oceanic pelagics

Peru has extensive resources of oceanic pelagics. The principal Peruvian oceanic pelagic resource appears to be tunas.[17] Foreign seiner and longline fishermen have at times reported extensive fisheries off Peru, both inside and outside the 200-mile limit. Despite several attempts, Peruvian fishermen have never succeeded in developing a successful tuna fishery to utilize this resource[18]. In contrast, foreign distant-water fishermen have conducted successful tuna fisheries off Peru and they have also reported substantial swordfish catches. Neighboring Ecuador has for years pursued a profitable tuna fishery and in recent years has reported success with longlining, including a few vessels targeting swordfish. Chile has developed both an artisanal driftnet and commercial longline fishery targeting swordfish.[19]

Peruvian artisanal fishermen, with assistance from U.S. tuna fishermen deploying freezer vessels as motherships, initiated a major swordfish fishery in the late 1940s and early 1950s. At the time, the Peruvian swordfish fishery was the most significant fishery in Latin America and the quantities involved were much larger than are currently reported by other Latin American countries. Since the 1950s this fishery has declined, with the exception of a few years in the early 1970s.

Peruvian fishermen have primarily attempted to use seiners in their unsuccessful efforts to harvest oceanic pelagics. The only commercial longlining until recently has been by foreign fishermen. A few companies and academic groups are now beginning to deploy a small number of longliners, but results have been mixed.

Bonito seiners: The fishermen developed an extensive bonito fishery in the 1940s using purse seiners to supply plants producing vitamins and subsequently canneries. Peruvian fishermen, however, turned to the abundant anchovy resource as the immensely profitable reduction fishery grew during the late 1950s and 1960s. Anchovy and bonito stocks were decimated by the 1972 El Niño event. The bonito catch fell from 64,000 t in 1972 to only 7,000 t in 1974.

Tuna seiners: Peruvian private and state companies attempted to initiate a tuna purse-seine fishery in the

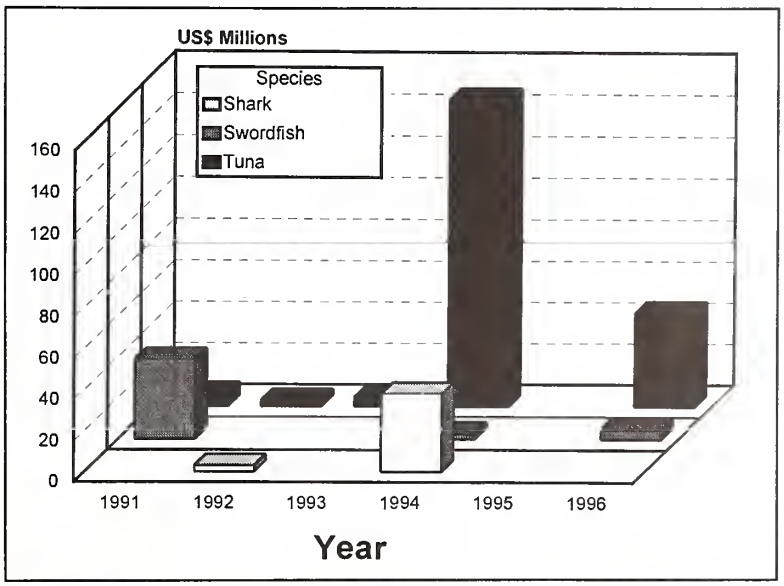


Figure 4.--Peru's exports of fresh oceanic pelagics to the United States are minimal and shipments through 1996 are not increasing.

***Photo 8**.--Peruvian efforts to initiate a commercial tuna fishery in the 1980s proved disastrous. Some new vessels were never even deployed and, like this vessel, eventually abandoned. D. Weidner*

1970s and 80s. Vessels were imported from Mexico, Peru, and the United Kingdom. A few small tuna seiners were built in Peruvian yards. Each of the attempts, however, proved financial disasters.[20] Some of the vessels were not even deployed (photo 8). The vessels that were deployed reported disappointing results.

Longliners: Academic and commercial groups beginning in the late 1980s have attempted to launch a domestic longline fishery. The most significant attempt deploying large commercial longliners has been Tuna Latin.[21] Other projects have been more modest. Many of the vessels involved are small, but a few companies are introducing improved technology and gear. While the principal target species are tuna and sharks, small incidental swordfish catches are reported. The commercial tuna longline ventures have failed. One company (Sindicato Pesquero) is deploying new vessels in a directed swordfish fishery. The longline catches are still relatively limited and shipments of high-quality fresh products produced in the fishery remain minor. There has been some growth in recent years. Shipments of fresh oceanic pelagics to the United States, Peru's primary market, reached nearly $190,000 in 1994, but have subsequently declined (appendix E2c and figure 4). Most of the shipments are tuna. Despite the failures, some of the companies involved are still optimistic about the country's potential, even though 1996 exports to the United States were well below 1994 levels. The overall trend of fresh fish exports does not appear to confirm any successful expansion of the longline fishery for high-value oceanic pelagics. (See "Markets".) The involvement of Sindicato Pesquero, Peru's largest fishing company, could bring the managerial and technical resources needed to successfully initiate a new fishery. The limited results achieved to date by other Peruvian companies, however, may reflect a marginal commitment by Peruvian companies rather than resource limitations. Fishing companies are assessing the failed projects in the 1990s to determine the causes. One company (Tuna Latin) is convinced that onerous regulations passed by Congress are responsible.[22] Government officials often reply that the industry simply has shown little interest.[23] Other companies (Grupo Sotomayor) are still unsure about why their longline ventures failed.[24] Some local observers note that the success of Peru's fishermen and companies in easily landing tons of small pelagic fish from coastal operations has created a mind set that is difficult to break. This experience has made it hard to convince fishermen and companies to invest in unfamiliar and costly gear, equipment, and vessels requiring more sophisticated operations and new skills. The results are much smaller quantities. Even though the smaller catch may be more valuable, it requires a much different mind set and it may be difficult for experienced fishermen to adjust. Government officials believe that the cost of building dedicated vessels and the unfamiliar technology involved discourage many potential new entrants. Many alternative species are apparently accessible to artisanal fishery with substantially lower investments. The size and cost of vessels capable of reaching potential swordfish grounds and storing such large fish requires investments beyond the means of many artisanal fishermen.[25] The significant profits from the fishing industry still come from the fishmeal industry. As a result, the industry's attention remains fixed on fishmeal.[26]

II. Species

Little information is available on swordfish behavior off Peru. Despite the country's enormous fishing industry, the Peruvian fisheries research effort supporting fisheries is limited. The severe financial problems encountered by Peru during the 1980s caused the Government to severely restrict spending and even well-respected research groups like the Instituto del Mar (IMARPE) have been adversely affected. The research still conducted is very narrowly focused. IMARPE is the country's principal fisheries research institute and is recognized as one of the premier fisheries research institutes in Latin America. The budgetary limitations have, however, severely constrained its operations. Most of the research work conducted has concentrated on the country's massive small pelagic fishery and a few other important resources such as hake. (See "Research".) Very limited resources have been available to work on other species such as oceanic pelagics (even tuna) which are not heavily targeted by domestic fishermen. No studies at all have been conducted addressing swordfish stocks and behavior off Peru. Some preliminary assessments, however, are possible using available catch and trade data. The authors have also noted a few references to Peruvian swordfish in a variety of press reports and general studies, mostly work by foreign fishermen and researchers.

A. Stock structure

Swordfish occur off Peru, both within and beyond the country's 200-mile EEZ. Historical records suggest that the swordfish population has at times been substantial. (See "Catch".) No actual studies, however, are available on the stock structure and relationship to other Pacific populations. Even the Japanese who have fished swordfish for years in the eastern Pacific are unsure about the relationship between swordfish off Chile and Peru.[27] Several researches have considered the structure of the Pacific swordfish population and some tentative theories have been postulated. There is a growing consensus that swordfish in the northern and western Pacific appear to be part of a large pan-Pacific stock, although considerable discussion on the issue continues.[28] Some indicators suggest that the population off Peru may be part of a separate, but not isolated, southeastern Pacific stock occurring along the South American Pacific coast (Chile, Peru, Ecuador, and Colombia) and adjacent offshore waters. The authors stress, however, that such a conclusion is still tentative.

Several factors support the theory that swordfish in the southeastern Pacific are a single stock, probably separate from other Pacific swordfish. Evidence in some areas is weak, data limited, and some reports contradictory. Most significantly, no tagging studies exist to confirm a separate southeastern Pacific population. Overall there is, however, evidence suggesting the existence of a possible separate, but not completely isolated southeastern Pacific stock.

Oceanography: Swordfish abundance appears to be associated with current flows along the South American coast and in offshore areas.

Coastal waters: The northward-flowing Humboldt Current creates a coherent Large Marine Ecosystem (LME) and swordfish movement in the southeastern Pacific appears to be associated with it for at least part of the year. (See "Fishing Grounds".) Such currents and the LMEs associated with them are play important roles in the movement and distribution of species, including highly migratory species like swordfish. Swordfish are known to take advantage of current flows in some areas for at least part of the year. Different swordfish populations within such an LME would be unlikely. The Humboldt Current is the dominant oceanographic feature along most of the Pacific coast off South America, although its influence varies seasonally along the northern coast off northern Peru, Ecuador, and Colombia. The impact of the Humboldt Current is partly reflected in the similar species mix and shared stocks, including prey species, found off northern Chile and Peru. Thus, it seems plausible that the swordfish population off southern Peru is the same as that found off central and northern Chile. Swordfish movement within the Humboldt LME is unclear. The authors, however, know of no study assessing the impact of the Humboldt and other currents off Chile and Peru on swordfish. The limited current swordfish catch off Peru may mean that only a small proportion of the large Chilean population follows the Humboldt Current into Peruvian coastal waters or, more likely, it may reflect the small Peruvian effort targeting swordfish.[29] Foreign catches, confirm that swordfish are present in commercial quantities in coastal waters off southern Peru. If swordfish were simply following the Humboldt Current north, one might expect catches in coastal waters all along the Peruvian coast. Several sources have reported catches off both northern and southern Peru, but there also appears to be an area along the northcentral coast where swordfish is normally not taken in significant quantities.[30] The relationship with swordfish off southern and northern Peru and in inshore and offshore areas is not clear.

Photo 9.--Foreign longliners, like this Spanish vessel, are deployed for tuna and swordfish in the southeastern Pacific off Chile and Peru. José Echeandía Zegarra

Offshore waters: Swordfish catches are often associated with oceanic current flows, especially the areas of strong temperature fronts associated with these areas.[31] This also seems to be the case in the southeastern Pacific where catches and yields (Ecuador, figure 8 and Peru, figures 9 and 10) appear to cluster with an-east-west axis in offshore waters.[32] This matches the east-west axis of the oceanic current flows (Colombia, figure 10) and thermal fronts (figures 12 and 13). This clustering pattern suggests that swordfish may be primarily associated with westerly flowing currents, but the data available to the authors is not sufficiently precise to confirm this.[33]

Annual catch trends: Available swordfish catch data from the southeastern Pacific show some similarity in annual patterns which would support the common southeastern Pacific stock theory. Most but not all of the active fisheries are reporting declining catches. The available data, however, has serious limitations and significant lapses. The Japanese have collected a comprehensive data set from their longline fishery, but the fact that swordfish was not the target species seriously compromises the data. Some coastal countries have not collected or published detailed swordfish data. The Peruvian data may not reflect resource availability as much as economic and employment trends. Chilean trends, however, do correlate somewhat with the Japanese trends. Chilean trends, especially off the northern coast, are probably a good reflection of the situation off southern Peru.

Peruvian data: Peruvian swordfish catch trends have fluctuated significantly in recent years, although available catch data describing these fluctuations are somewhat limited. Historical data showing increases during the 1940s and subsequent declines in the 1950s are somewhat similar to the Chilean pattern, although the Peruvian fishery appears to have peaked in 1950 and the Chilean fishery earlier in 1946 (appendix B2a and Chile appendix E2a1). There is no similarity in catch trends since the mid-1980s when Chile initiated a major fishery for swordfish. Given the limited Peruvian fishing effort during the late 1980s and 1990s, the recent fluctuations in the Peruvian domestic fishery are probably not statistically significant and do not reflect species abundance. Thus they would not necessarily fluctuate like the Chilean fishery, even if there was a common stock.

Spanish fishery: While no catch data is available, the withdrawal of Spanish fishermen operating from Peruvian ports in 1994-95 may be a better indication of catch trends then actual Peruvian catch data (photo 9). The withdrawal tends to suggest declining catches and thus confirms the Japanese and Chilean trends, further evidence of a common stock. There were, however, a few Spanish fishermen who returned to the southeastern Pacific in 1996 (appendix A2 and Chile, appendix D4).[34]

Ecuadorean data: Available Ecuadorean data is confusing and can not be used at this time to assess annual patterns (Ecuador, appendix B2a).[35] Anecdotal reports in 1996 and 1997 suggest that swordfish catches are increasing, a trend which has been confirmed by U.S. import data (Ecuador, appendix D2a). This aberration from a general catch decline in the southeastern Pacific appears to reflect the opening of new, formerly unfished grounds rather than trend lines in the existing fishery.[36]

Japanese longline data: The Japanese longline fleet in the southeastern Pacific (FAO area 87) has conducted the primary fishery harvesting the species during the 1960s-80s. Correlation with coastal state patterns could be possible evidence of a single southeastern stock. The authors stress, however, that the Japanese fishery is a multi-species fishery which in recent years has primarily targeted bigeye. Thus fluctuations in the swordfish catch may not necessarily reflect actual swordfish abundance. The Japanese swordfish catch peaked in 1992 at 1,027 t (Latin America, appendix C2b). The Japanese catch had since declined to only

***Photo 10**--Chile has developed Latin America's largest swordfish fishery deploying both commercial longliners as well as a variety of artisanal boats which primarily use driftnets. D. Weidner*

689 t in 1994. Peru does not currently catch sufficient swordfish to develop statistically meaningful catch patterns. The Japanese pattern is, however, similar to the Chilean pattern, part of which is conducted off northern Chile adjacent to southern Peru.

Chilean data: The Chileans like the Japanese have reported major catch declines in the 1990s (photo 10). The Chilean fishery peaked at over 7,250 t in 1991 and has since declined to only 2,600 t in 1995 (Chile, appendix E2a1). This is similar to the Japanese catch pattern, although the Chilean decline has been much more precipitous.

Seasonal catch patterns: Similar seasonal patterns would be another indicator of a possible common southeastern Pacific stock. Available data does suggest some common patterns in the southeastern Pacific. The seasonal fluctuations, however, are highly complex and there appears to be significant differences in northern and southern areas where the fish is caught.

Peruvian data: The authors have analyzed available Peruvian catch data from 1968-95, but the time series is incomplete and during recent years the quantities involved have not been statistically significant. In addition, during these years, landings were almost entirely reported in northern ports with the exception of swordfish taken incidentally by factory vessels (appendix B3c2-d2 and figures 5-7). The best catches reported in 1968 were January to March, but this shifted during the 1970s to March through May. Then during the 1980s the best catches were reported during January-February and June (appendices B4a-b and figure 8). While the months have varied, IMARPE has consistently reported that the best fishing season in the north was during the first half of the year.

Chilean data: The Chilean commercial longline fishery is generally conducted to the north of the artisanal fishery, primarily off the northern and north- central coast.[37] Thus catch patterns in the fishery could be similar to patterns off the southern Peruvian coast. The Chileans report that the great bulk of the catch is taken from March through August, although there are some annual variations (Chile appendices E4a1-2). The most important months are generally April through June.

Japanese longline data: Japanese longline catch data show sharply contrasting seasonal patterns off northern and southern Peru. Some of the available statistical assessments of the Japanese data indicate varying patterns, perhaps resulting from differences in

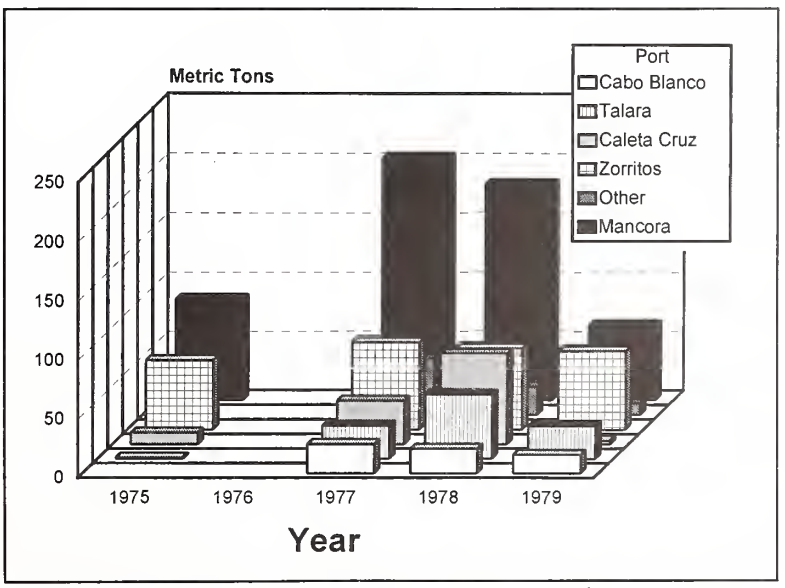


***Figure 5**--Peruvian fishermen landed almost all of their swordfish catch at northern ports during the 1970s, especially Máncora.*

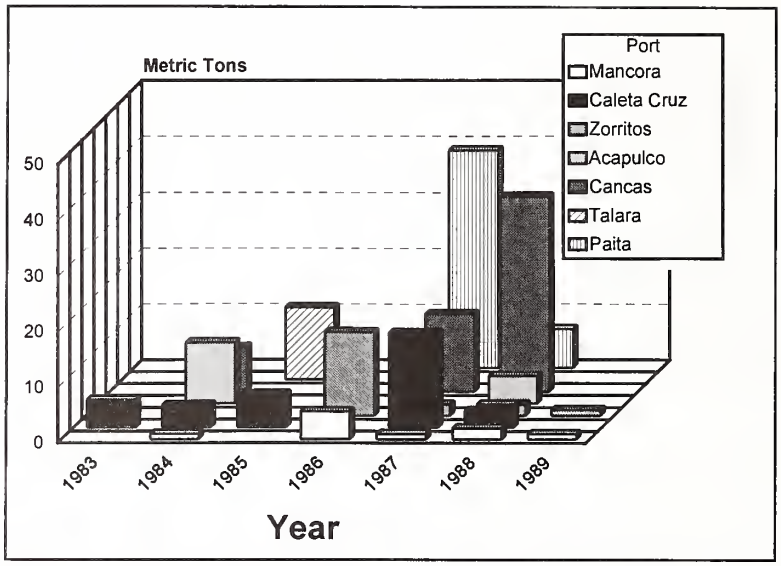


Figure 6.--Peruvian fishermen continued to land most of their swordfish in the north during the 1980s. The importance of each port varied significantly from year to year.

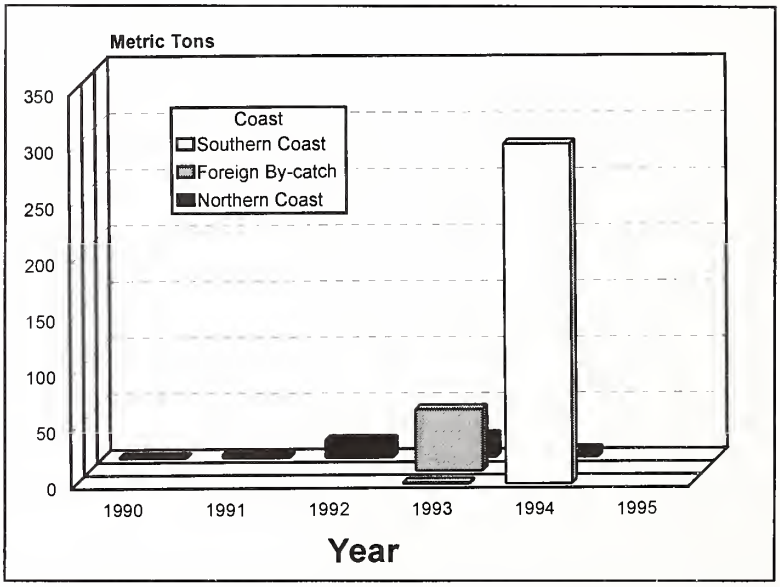


Figure 7.--Peruvians continued to land swordfish catches in the north during the 1990s, but very small quantities. Foreign fishermen landed swordfish by-catches in the south.

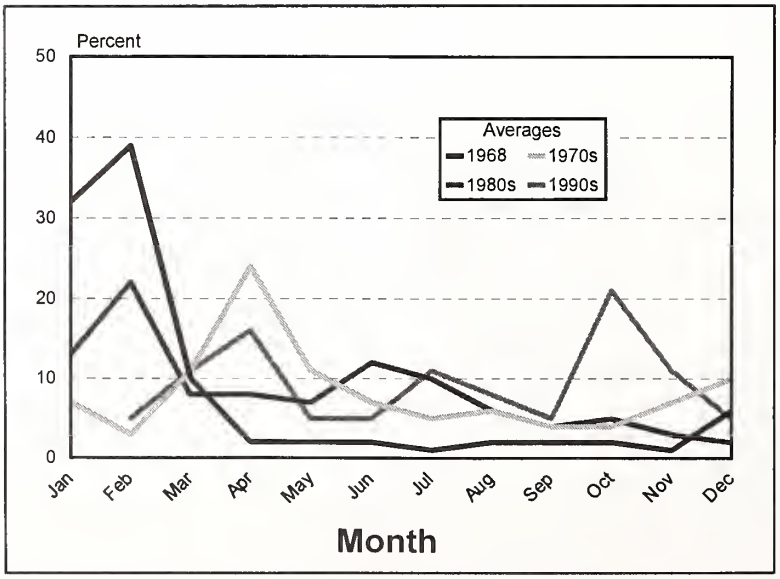


Figure 8.--Peruvian swordfish seasonal patterns have varied somewhat since the 1960s, but generally the best catches are reported at the beginning of the year.

the time period covered.

Northern coast: Along the northern coast there is little seasonal variation, although in recent years (1991-93) catches are somewhat better at the beginning of the year.[38] This generally confirms the available Peruvian data. An historical study of Japanese longline yields (1952-85) shows a more mixed picture, providing no clear seasonal pattern along the northern coast (figures 9 and 10). The best months off Ecuador and northern Peru were February, April-May, and August-December.[39]

Northcentral coast: Along the northcentral coast the seasonal pattern during recent years was similar to the northern coast, but yields were much lower.[40] An historical yield study confirmed poor yields along the northcentral coast and the resulting lack of effort makes it difficult to assess a seasonal pattern.[41]

Southern coast: Along the southern coast and adjacent offshore areas the best catches are reported in the second and third quarters.[42] This generally confirms the Chilean data. An historical study of Japanese longline yield also generally confirms the pattern; the best months were April, July, and September.[43]

Geographic catch patterns: Geographic catch patterns provide some of the strongest evidence of a separate southeastern Pacific stock. The principal swordfish fishery in the south-eastern Pacific has been the Japanese fishery, which clearly shows a distinct clustering of good catches and high yields in the south eastern Pacific (Ecuador, figure 8). When coastal catches (Ecuadorean, Peruvian, and Chilean) are added to the assessment there is even a more pronounced clustering (Chile, figure 13).

Japanese longline data: Japanese longline fishermen during the 1990s reported good swordfish catches in the southeastern Pacific, stretching from latitudes off Colombia to southern Peru, out to about 150°W.[44] Japanese catch data, for example, show an unbroken area of swordfish catches stretching from the Ecuadorean and Peruvian coasts (70-80°W) out to about 145°W, before beginning to fall off.[45] Other authors have also reported a clustering of catch or yields in the southeastern Pacific, although the pattern and extent of that cluster varies.[46] Notably one of the enduring features in the southeastern Pacific cluster is a persistent area off the northcentral Peruvian coast where little swordfish was taken. The lack of fishing reported by the Japanese off Chile in recent years probably reflects Chilean enforcement capabilities and the policy of not licensing foreign swordfish fishermen. Japanese longline data covering a longer period show similar clustering and very high yields off northern Chile.[47] The relatively tight clustering produced from a visual plotting of Japanese

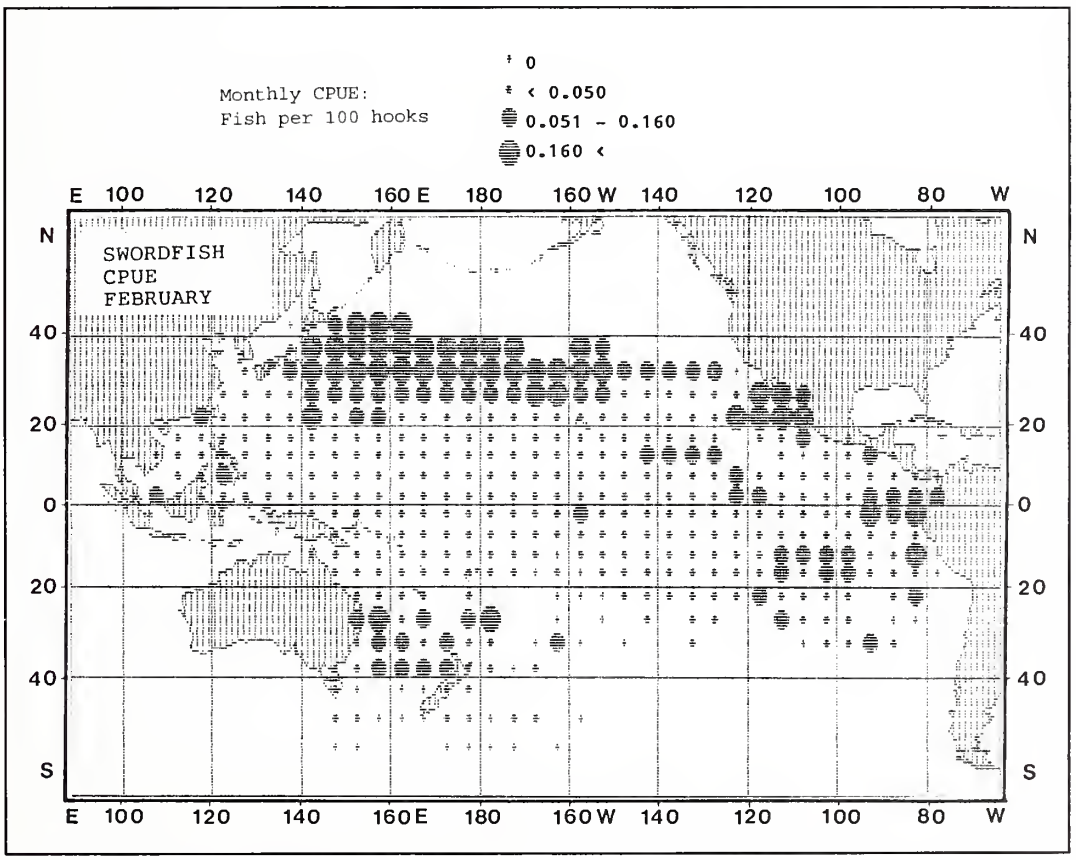


Figure 9.--The Japanese reported relatively good fishing off northern Peru in February, but the seasonal pattern is difficult to determine. Sosa-Nishizaki and Shimizu.

longline catches and yields strongly suggest a relatively, but not completely, isolated southeastern Pacific population (Ecuador, figure 8 and Peru, figures 9 and 10).[48] Japanese longline fishermen, especially in recent years have reported no swordfish catch along the Chilean coast.[49] This appears to reflect Chilean exclusion of foreign fishermen from its 200-mile zone, rather than an absence of fish.

Peruvian data: Peruvian catch data shows swordfish taken almost exclusively along the northern coast (appendices B3 series and figures 5 and 6). The absence of catches reported along the southern coast appears to reflect lack of Peruvian effort because

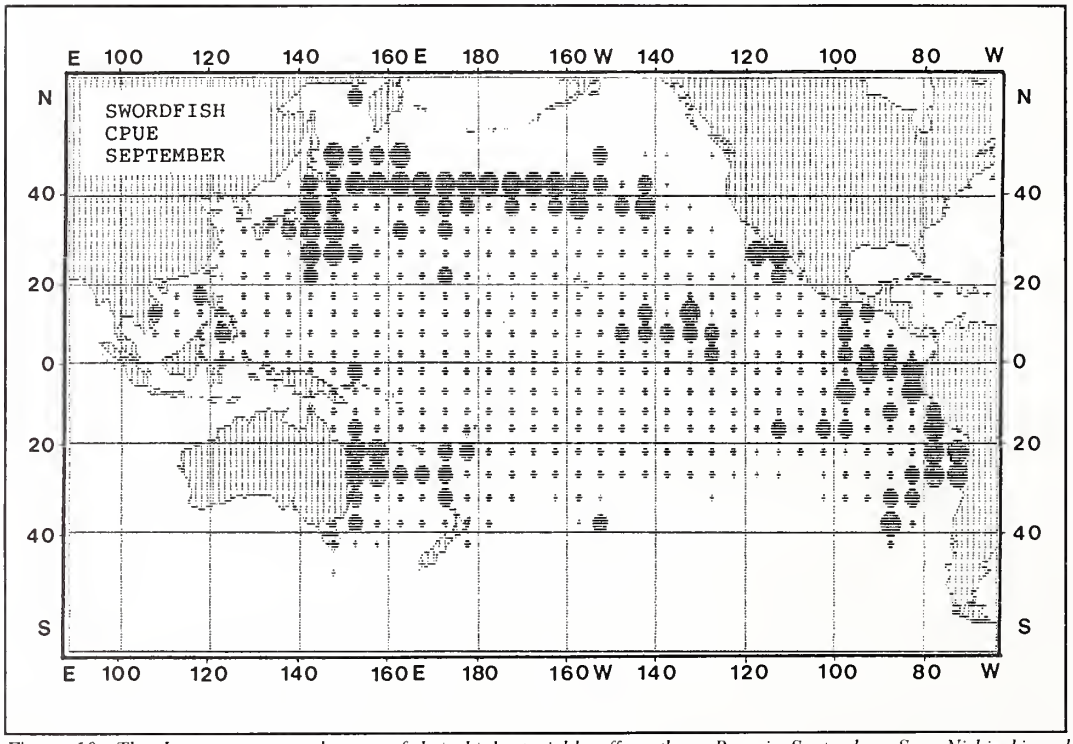


Figure 10--The Japanese reported some of their highest yields off northern Peru in September. Sosa-Nishizaki and Shimizu

Japanese and Chilean fishermen report catches in the area. The Peruvian data adds to the southeastern Pacific clustering reported by the Japanese.

Chilean data: Chilean fishermen since the mid-1980s have reported very substantial catches along its central and northern coast in both coastal and offshore areas (Chile appendices E2e1, E2g and E2h1-2).[50] The substantial Chilean catches also provide further evidence of a notable clustering of catches in the southeastern Pacific. When added to the cluster of Japanese yields and catches (Ecuador, appendix 8 and Peru, appendices 9 and 10) it shows and even more distinct cluster extending down to coastal waters off central Chile.

Spanish data: The authors have no data on Spanish Pacific grounds. Given that the fishermen operate primarily from Ilo in southern Peru and desire to operate from Chilean ports to the south, they clearly are fishing in the southeastern Pacific, as far south as 43°S. Anecdotal reports from Peru and Chilean Naval data confirm this (Chile, appendix D4).[51] The Spanish appear to be fishing primarily at latitudes off southern Peru south to central Chile. Some reports suggest they may fish as far north as Ecuador.[52] (See "Fishing Grounds".) Thus the Spanish activity provides more evidence of a clustering of swordfish catches in the southeastern Pacific, presumably enlarging the area suggested by Japanese data to the south. It is not know, however, with any precession how far into the oceanic waters of the eastern Pacific that the Spanish vessels operate. One Chilean source 320-800 kilometers.[53] Another source indicates Spanish operations out to 84°W which would be about 1,500 km off Chile, but less off Peru as the coast runs northwest.[54]

Yield trends: Yield trends reported in the southeastern Pacific appear similar, but not identical. Chilean researchers have since 1991 reported very significant declines in yields.[55] Japanese fishermen have reported declining yields since 1986, but not nearly as drastic as those reported by the Chileans during the 1990s.[56] Peruvian data shows extremely limited swordfish catches (appendix B4a), but no data is available on effort. (See "Stock status" below.) The withdrawal of the Spanish swordfish vessels in 1994-95 suggest that their operations from Peruvian ports were experiencing disappointing yields, although a few vessels returned to the Pacific in 1996 (appendix A2).

Genetics: Chilean researchers are planning a genetic electrophoresis to attempt to assess the relationship of swordfish off Chile with that off Peru and the southeastern Pacific as a whole.[57] The authors know of no genetic work in Peru. Preliminary studies by U.S. researchers, however, have found fish off Chile and Ecuador to have basically identical genomes.[58] The U.S. researchers also note significant diversity with other Pacific fish.[59] Although no samples have yet been studied from Peru, if Ecuadorean fish are genetically identical to Chilean fish, almost certainly fish off Peru will also have identical genomes. This is strong evidence that Peruvian fish are part of a population occurring off Ecuador south to Chile which may be separate, but not isolated from a larger pan-Pacific stock.[60] This conclusion, however, is still tentative and not shared by all genetic researchers. A Japanese geneticist, for example, using different methods from the U.S. research group has not found evidence confirming a separate southeastern Pacific stock.[61]

Migratory patterns: Migratory movements also provide some indications that the swordfish off Peru are part of a separate southeastern-Pacific stock. The fish off southern Peru appear related to the large population off Chile as the fish begin to appear off southern Peru about the same time that they move out of Chilean waters. (See "Seasonality" and "Migrations" below.) This appears to be part of a circular movement of fish extending west and then south before turning east again to approach the Chilean central coast.[62] Migratory movements off northern Peru, however, appear more complicated. The seasonality and thus migratory movement of the fish in the north appear markedly different than off southern Peru. In addition there is an area along the northcentral coast where swordfish do not appear abundant. (See "Distribution" below.) Thus there may not be a significant movement of the fish north along the coast from southern to northern Peru, despite the prevailing northern-flowing Humboldt Current. Exchanges may be more prevalent in offshore waters.

B. Distribution

Swordfish are known to occur off Peru, both within and beyond the 200-mile EEZ. No stock assessment studies, however, providing information on swordfish distribution off Peru are known. The authors know of no Peruvian or foreign studies describing swordfish distribution and changes over time. Information on swordfish distribution off Peru is based almost entirely on data derived from the fishery. Both domestic and foreign fishermen have compiled catch and landings data. Some information is available on the grounds targeted and the landing sites, providing possible insights on species distribution.[63] Historical Peruvian landings data provide some insights, although the Peruvian catch in recent years has been so small that it does not provide a useful indication of distribution. Increasing activity in 1997 may provide more useful data. Foreign studies and fishery statistics provide more insight into the possible current distribution off Peru. Japanese longline fishermen provide the most extensive data set. Japanese swordfish catches, which in part reflect actual abundance, have varied substantially from year to year, but at least some fishing has been reported annually from Colombia south to Chile.[64]

The historical Peruvian fishery appears to have been primarily off the extreme northern coast around Cabo Blanco. The foreign fishermen active in the 1990s have generally focused their effort off the southern coast. Neither Peruvian nor foreign fishermen, however, have ever reported significant catches along the northcentral coast.

Peruvian fishermen: The primary focus of the directed fishery in the late 1940s through the 1970s was primarily coastal waters along the extreme northern coast (north of 5°N). Subsequent Peruvian fishing has been much less intense and has included reports of good yields off the southern coast at some distance from the coast.

Primarily northern: No historical Peruvian data is available by fishing areas. IMARPE has, however, published some landings data by port. Given the limited range of the harpoon vessels, the location of the landing site is probably a good, albeit rough, indication of where the fish was caught. The large catches reported during the late 1940s and early 1950s (appendix B1) were primarily landed at ports along the extreme northern coast (north of 5°N), in all but a few exceptional years (appendices B3 series). The most important ports were usually the northern ports of Cabo Blanco, Caleta Cruz, Máncora, Talara, and Zorritos. All of these ports are located at or north of 5°N. Cabo Blanco is more important than suggested by the data. Many fishermen operating off Cabo Blanco landed the catch at other nearby ports with larger fishery markets rather than at Cabo Blanco. The company (Sindicato Pesquero) planning to initiate swordfish longlining in 1997 confirms that the area around Máncora has traditionally been the most important fishing area.[65] The abundance of swordfish off northern Peru apparently is in part due to the confluence of the cold Humboldt current with the warmer equatorial water off northern Peru and Ecuador. (See "Fishing Grounds".) Historical reports also suggest some limited fishing off the southern coast.[66] The authors do not, however, know of any

significant catches along the northcentral coast and none have been reported by IMARPE (appendices B3 series). The company (Sindicato Pesquero/SIPESA) which has begun to longline swordfish, reports the best early results in the south off Matarani and Ilo during 1997 (appendix B8a1). One of the captains involved believes that poor 1997 catches off the northern coast may be due to abnormally high water temperatures in the north as a result of the developing El Niño.[67]

Primarily coastal: Reports during the early 1950s indicate that the fishery was conducted relatively close to shore, 65-80 kilometers (km) from port. This may reflect the limited range of the small artisanal vessels in use at the time and thus does not indicate that the fish were not abundant further offshore. Some reports suggest that the fishermen occasionally fished up to 400 km off the coast, but such effort must have been relatively rare given the small vessels used. Peruvian commercial fishermen have since reported catches both within and beyond the country's 200-mile zone. One Peruvian company which has now ceased operations (Consorcio Pesquero) reported catches as far as 1,600 km off shore during 1995-96.[68] The authors believe that few other Peruvian fishermen are conducting such distant operations. SIPESA's swordfish trials in 1997 have been up to 600-700 km off the southern coast (appendix B8a1). Artisanal fishermen taking swordfish in 1997 because of the unusual El Niño conditions report catches with driftnet and lines very close to the coast.[69]

Foreign fishermen: Fishermen from several foreign countries have reported swordfish catches off Peru. Foreign catch and effort data provide further clues as to possible distribution patterns, although considerable caution is required when using this data as swordfish was not the target species.[70] Currently the major foreign effort is deployed by Japan and Spain. Unlike the Peruvian fishermen who landed much of their catch in the north, the Japanese and Spanish have reported catches off the southern coast. This may in part reflect varying yields from inshore and offshore fisheries because the Peruvians off the northern coast fished close to the coast while the foreigners in the south generally fished further off shore.

Japanese fishery: The most detailed reports have been compiled by the Japanese longline fishermen. The Japanese catch and yield data provide some suggestions as to the distribution of swordfish off Peru, but should be treated with considerable caution.[71] The Japanese fishery in the ETP during the 1990s has been primarily conducted well out into the Pacific, west of 100°W. They have also been active in coastal waters off southern Peru (10°-20°S), and to a lesser extent off Ecuador and extreme northern Peru (0°-5°S). The Japanese, like the Peruvian fishermen, report negligible catches off Peru's northcentral coast (5°-10°S).[72] Available Japanese yield (CPUE) data for 1952-92 showed a similar pattern of fish being taken off Ecuador and northern Peru (0°-10°S), and to the south off southern Peru and northern Chile (20-30°S). Notably there was also an area in between, off northcentral Peru (5-10°/15°S) where swordfish appear much less abundant.[73] Another study of Japanese longline data for 1952-85 confirms that for much of the year swordfish availability along the northcentral coast is limited and that the best grounds are either extreme northern Peru (0°-5°S) and southern Peru/northern Chile (15°-25°S) (figures 9 and 10).[74]

Spanish fishery: Spanish longline fishermen have been active in the eastern Pacific during recent years. (See "International".) While they have not released data on their operations, they appear to have focused primarily on latitudes off northern Chile and southern Peru. Much of the Spanish effort appears to be conducted off Chile as far south as 35°S, roughly off Talcahuano. One Chilean source indicates that the Spanish operate as far south as Coquimbo (about 30°S).[75] A Peruvian source roughly confirmed the Chilean estimate, indicating that Spanish fishermen operate from 5°S-35°S and that grounds 500 km west of Chile's Juan Fernandez Islands were particularly important.[76] A Chilean fishermen working with a Peruvian company reports operations are primarily conducted from central Chile to southern Peru, but some activity is reported from 43°S north to Ecuador.[77] Such operations are roughly confirmed by Chilean Navy data (Chile, appendix D4). Various reports have been received concerning the distance off the coast that the Spanish operate. One report suggests operations as far as 84°W.[78] This would mean about 1,500 km off northern Chile, but somewhat less off Peru because the coast runs to the northwest.

Other foreign fisheries: Chilean fishermen began longlining in the late 1980s and have done some test fishing at latitudes off Peru and Ecuador. One Chilean study of eastern Pacific longline fisheries beyond the Chilean, Peruvian, and Ecuadorean 200-mile zones reported a swordfish by-catch along with the tuna catch.[79] Other foreign fishermen deploying longliners (Korea and Taiwan) in the southeastern Pacific have not targeted swordfish in recent years (Latin America, appendix C2b). Thus no insights are available on swordfish distribution. Taiwan is active in the south Pacific (10°-35°S), but well to the west of Peru. Taiwan in 1992, for example, did not report billfish (including swordfish) any closer to the South American coast than 110°W.[80] This is in sharp contrast to the much more active fishery along the Atlantic coast of South America, although the primary

target species in the Atlantic are tunas (albacore, bigeye, and yellowfin).[81] Korean longliners have reported some activity in the ETP: off Ecuador and Colombia (1988-89), off Peru (1990), off Colombia, Ecuador, Peru, and Chile (1991), and Colombia, Ecuador, and Peru (1992).[82] The Koreans reported tuna catches, but very little swordfish (Latin America, appendix C2b). Normally tuna longlining would also take incidental swordfish catches, but Korea has reported no swordfish catches in the area since 1991 and no significant catch since 1980.

C. Migrations

The authors know of no studies describing swordfish migrations off Peru which can only be confirmed with certainty through tagging studies. Seasonal fluctuations in the fishery and a few scattered observations, however, provide some insights into possible migratory movements. Available catch and yield data suggest that swordfish seasonality off Peru appears highly complex, especially at tropical latitudes. Attempts to use the data to construct possible migratory patterns has proven difficult.[83] One clear conclusion is that there are clearly sharp differences in swordfish behavior off the southern and northern coast. Distinct seasonal patterns off the southern coast suggest a distinct circular migratory pattern in the southeastern Pacific, although there appears to be a residential population of juveniles on the Nazca Ridge. Migratory behavior along the northern coast is less clear. The authors at this stage can only speculate on migratory behavior using the limited seasonal data available because the absence of tagging data makes it impossible to draw any firm conclusions.

Seasonal trends: The seasonality of swordfish appears to vary significantly off the northern and southern coast. The fish appear to be present in commercial quantities off northern Peru all year round, although they appear to be more abundant at the beginning of the year. There are much more marked seasonal fluctuations along the southern coast suggesting an annual circular migratory route.[84] (See "Seasonality" below.)

Northern coast: Migratory movements based on the available seasonal data are highly complex and difficult to assess off northern Peru.

Southern coast: Seasonality off the southern coast suggests a circular pattern running from feeding grounds along the central Chilean coast north and then west to spawning grounds in oceanic waters and then south and west back to the Chilean central coast. The seasonable pattern off southern Peru, corresponds closely to this theorized migratory pattern.[85] Such a close correlation suggests that the fish may be moving north from central Chilean to northern Chile/southern Peruvian before turning west into oceanic waters. There is some evidence suggesting that the swordfish off Chile may be following the migratory track of jack mackerel for at least part of the year.

Juveniles: Large numbers of juveniles have been noted off Peru's southern coast on the Nazca Ridge. This may in fact be a nursery area for juveniles which may not make the long migrations many of the adults appear to make. The juvenile population on the Ridge may be partly due to the availability of appropriate prey items.[86] (See "Feeding behavior.") Little has been written about the distribution of juvenile swordfish or presence on submarine structures.[87] Studies assessing sea mounts in the north Pacific, for example, have found they tend to aggregate swordfish, but available reports tend to describe adults and not juveniles. NMFS researchers working on swordfish in the north Pacific around the Hawaiian Islands have noted that juveniles are caught in relatively greater proportion at lower latitudes than adults. Notably the Hawaiian Islands and the Nazca Ridge are at similar latitudes.[88] Studies describing other oceanic predators often describe a different, more equatorial distribution, for juveniles than adults. Such differentiation may be especially true for swordfish as they do not school. Juvenile swordfish would seem to be vulnerable to cannibalism if they moved in the same area as adult fish.

1. Southern Peru

While no Peruvian data is available on swordfish off southern Peru, Japanese longline data suggest the fish off northern Chile and southern Peru are most abundant from April-June, but then appear to move west. The Japanese report that the fish are especially abundant in off-shore waters (80°-100°W) from July-September and later from October-December even further west (100°-145°W).[89] This suggests that the fish occurring off Chile and southern Peru may be moving west into oceanic areas during the latter half of the year. The close correlation of the seasonal pattern off Chile, suggests that swordfish off southern Peru may be involved in the same circular movement in the southeastern Pacific that is theorized for the fish off Chile.[90] The two leading reasons for swordfish migratory movements are feeding and reproductive behavior. Little data, however, is available on these two factors off southern Peru.

Feeding: Chilean researchers have identified jack mackerel ("jurel") as an important swordfish prey item.[91] Swordfish off Chile appear may be following the northern movement of jack mackerel along the coast. The seasonal and geographic pattern of Chilean swordfish and jack mackerel fisheries are similar.[92]

Less data is available on southern Peru. One fishermen has noted that the stomach contents are primarily squid and lesser amounts of horse mackerel ("caballa") in 1997 operations off southern Peru.[93] Peruvian fishermen , however, take little squid off the southern coast (appendix B7b2). Only limited data is available to the authors on the Peruvian jack mackerel fishery. One study indicates that jack mackerel occur in Peruvian waters as far north as about 10°S.[94] IMARPE reports that jack mackerel are regularly taken as far north as Paita (5°S).[95] Peruvian catch data suggests that jack mackerel off Peru are not as seasonal as off Chile, although the authors do not have data on jack mackerel seasonality by region. IMARPE reports catches off Peru throughout the year (appendix B7a).[96] Catches off southern Peru are currently limited (appendix B7b1-2 and figure 11). Peruvian fishermen are, however, just beginning to take jack mackerel in significant quantities, 0.3 million t in 1995 (appendix B7a). The species require larger vessels to assess grounds further off the coast than those vessels which target anchovy. As a result, current catches probably do not reflect the actual distribution of the species.

Reproduction: There is reason to believe that there is extensive spawning of swordfish south of 10-12°S in waters east of 110°W. (See "Spawning" below.) There appears to be a movement west of swordfish off Chile and Peru. The fish off Chile and southern Peru appear to be present in coastal waters at 70°-80°W (second quarter), 80°-95°w (third quarter) and 95°-145°W (fourth quarter).[97] This brings them into waters where the fish are believed to spawn. The authors note the presence of large numbers of juvenile swordfish to young to spawn on the Nazca Ridge off southern Peru. The movement of larval and juvenile fish, however, are unknown.

2. Northern Peru

The movement of swordfish off northern Peru and Ecuador is more difficult to assess. Both the Japanese and Peruvian catch data suggests an area along the central Peruvian coast where little swordfish is taken, suggesting a possible division at least in the coastal distribution. This is confirmed by the differing northern and central seasonal patterns. The fishery off the coast of northern Peru and Ecuador is less seasonal than in the south. Several interrelated factors could explain this, such as the less pronounced seasonal changes at tropical latitudes and the more moderate monthly fluctuations in prey items such as jack mackerel. The limited seasonality of the swordfish may reflect a less migratory group of fish, although not genetically distinct. The rarity of larvae in coastal areas, suggests that the fish are not spawning, even at the tropical latitudes of northern Peru and Ecuador.[98] The varying seasonality in Japanese longline catches as one moves west also suggests possible migratory behavior.[99] Feeding behavior in the north may be distinct to the pattern along the southern coast. There appears to be a sizeable squid resource off northern Peru which may affect distribution. The squid population, however is highly variable which could affect swordfish distribution. The squid population can decline dramatically when the water cools.[100] The foreign companies purchasing Peruvian squid licenses, for example, reported a disastrous squid season in 1996.[101] The differing seasonal patterns of prey species could partially explain the different swordfish seasonal patterns off northern and southern Peru.

3. Mixing

Genetic studies suggest some mixing of southeastern Pacific and the wider pan-Pacific stock in the waters off the United States (California) and Mexico (Baja California). Genetic researchers report that swordfish off California and Baja show a mixed genetic pattern.[102] The migratory track of the theorized southeastern stock to and from the Baja/southern California is unknown. No tagging studies have been conducted.[103] Available catch and effort data, however, show severely limited swordfish catches and low yields along much of the coast off Central America and southern Mexico.[104] While catches are limited, there does appear to be a seasonal shift north from latitudes off Colombia (second quarter), Nicaragua (third quarter), and Mexico (fourth quarter).[105] This suggests that primary exchanges between the southeastern Pacific and northern Pacific fish in a mixing area off the Baja may not be along the coast.

D. Spawning

No data is available to the authors on swordfish maturation off Peru. Some observations, however, especially the absence of larval swordfish and substantial quantities of immature fish suggest that the fish do not spawn off Peru.

Absence of larvae: Peruvian researchers report that they have not detected swordfish larvae. IMARPE has for years conducted extensive plankton surveys. IMARPE's primary focus has been on small pelagic species, but researchers have never noted a swordfish larvae in their plankton work.[106] Researchers in most neighboring countries (Colombia and Chile) as well as in Mexico and the United States have also failed to detect swordfish larvae in ETP coastal waters, although one Ecuadorean researcher reports

finding some.[107] Distant-water researchers have also failed to find swordfish larvae in oceanic waters of the ETP. No swordfish larvae have been noted in ETP plankton studies, east of 108°W.[108] While the research effort in the ETP has been much more limited than in the western and central Pacific, the absence of detected larvae strongly suggests that the fish do not spawn off the South and Central American coast, even though temperature levels are appropriate.

Low gonadal indices: The Chilean Instituto de Fomento Pesquero (IFOP) has published the only known study on swordfish maturation in the ETP. The IFOP researchers found that swordfish off Chile had very low gonadal indices (Chile, appendix B7).[109] The indices are so low off Chile that the fish are unlikely to reach spawning readiness even 1-2 months after leaving Chilean waters. The recreational fishermen active off Chile and Peru in the 1940-50s collected data on swordfish, including gonad weights, but the authors have been unable to find the tabulated results.

Presence of juveniles: The substantial number of juveniles reported off southern Peru, especially on the Nazca Ridge off southern Peru, are fish not yet capable of spawning. (See "Sizes" below.) Details on the movement of the small post-larval fish to the Nazca Ridge and migratory movement off the ridge are unknown.

Oceanic larvae: There is some evidence suggesting that swordfish spawning takes place well west of the Peruvian coast. Scattered larvae have been found west of 108°W which would be about 300 km west of Ecuador's Galápagos Islands. The most comprehensive Pacific plankton study has been conducted by the Japanese Far Seas Fisheries Research Laboratory (JFSFRL). They found increasing quantities of swordfish larvae at 10-12°S, which would be latitudes off northern Peru.[110] Unfortunately JFSFRL did not conduct tows south of 12°S, so the spawning area for the theorized southeastern Pacific stock is still unclear.

E. Seasonality

Some limited information is available on seasonal swordfish patterns off Peru. All of the data is fisheries-dependant, however, and must be used with some caution, especially as the target species was bigeye tuna and not swordfish. Considerable differences exist between available sources, perhaps due to the different time periods, gear, and/or grounds covered in the various studies. Despite these differences, some discernable patterns are apparent. The most obvious pattern is significant seasonal differences between swordfish off Peru's northern and southern coast. Not only are seasonal patterns less pronounced in the north, but the monthly pattern is different from that noted in the south.

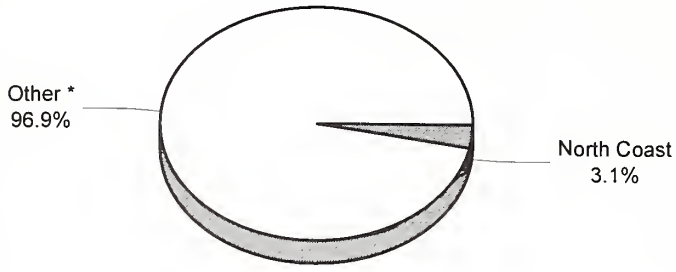
Peruvian harpoon data: The authors have reviewed monthly Peruvian catch data, although the data set available to the authors is incomplete with many missing years. Some of the data suggests catches peaking early in the year, especially during January and February. Catches in 1968, for example, were mostly taken at the beginning of the year (appendix B4a-b and figure 8). (No other 1960s data is available.) Catches during the 1980s also peaked at the beginning of the year, although some substantial catches were reported through July (appendices B4a-b and figure 8). This suggests the highest catches were taken after the peak Chilean season ended in August and September. The Peruvian catch data for the 1970s, however, shows a more mixed pattern. Peruvian fishermen reported substantial catches (appendix B4a-b) during what was to become the peak Chilean season (Chile, appendix E2c1, E2d1, E2e1, E3a1, and E4a1).[111]

Current Peruvian fishing: Sindicato Pesquero which plans to begin longlining swordfish in mid-1997 reports that swordfish are most abundant in the north off Máncora during the summer (late November to March).[112] This roughly confirms the 1980s data mentioned above.

Japanese longline data: Japanese longline data provides some indications on seasonal patterns. Swordfish seasonality is clearly different along the northern and southern coasts with an area along the central coast where the species appears less abundant. Different authors, however, provide somewhat conflicting assessments of the actual monthly patterns involved.

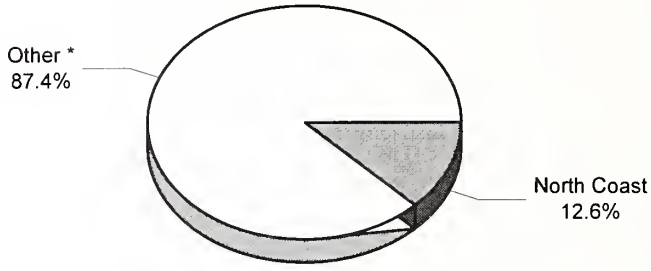
Northern coast (3°-5°S): The best northern ground appears to be from 0°-5°S, which is Peru's northern-most coast and much of the Ecuadorean coast. Swordfish abundance along Peru's northern coast does not fluctuate as widely as in the south, but there are seasonal fluctuations. Available sources provide conflicting seasonal assessments, although it is possible this may be due to the different time periods covered in the different studies. One study of longline yields, based on historical data (1952-85), indicates that high yields were reported during the later half of the year (August-December), but there were also several good months in the first half (February and April-May) (figure 9 and 10).[113] A more recent study (1991-93) of longline catches indicated that the best catches were reported from January to March, but the seasonal fluctuations were not nearly as marked as off the southern coast.[114]

Central coast (5°-10/15°S): Several studies of the Japanese longline fishery reveal poor yields or limited fishing along Peru's north central coast (5°-10°/15°S),



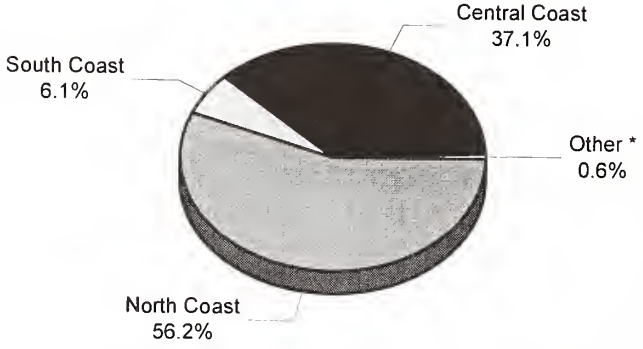
**1992 Squid Catch:
107,100 Tons**

* Foreign factory vessels



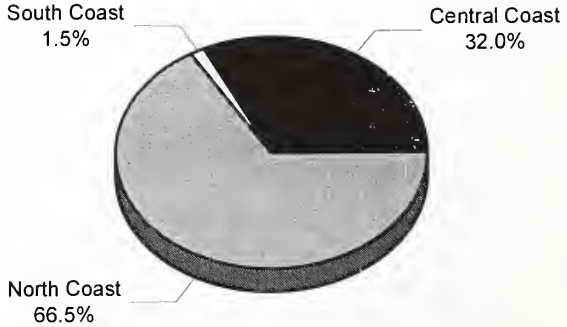
**1994 Squid Catch:
188,800 Tons**

* Foreign factory vessels



**1992 Jack Mackerel catch:
51,200 Tons**

* Foreign factory vessels



**1994 Jack Mackerel catch:
151,300 Tons**

Figure 11 --Almost all of Peru's domestic squid catch is reported and most of the foreign factory vessel catch is also reported in the north.

south of Máncora and Cabo Blanco.[115] Seasonality in this area is mixed. Recent catch data suggests it is similar to that off Ecuador in coastal waters, but similar to southern Peru in offshore waters.[116]

Southern coast (10°/15°-19°S): An historical study found yields to be highest in the south during July and September, but immediately to the south off northern Chile there was a much longer period of high yields (June through October). Recent catch data shows the best season is April-June in coastal waters and July-August further off the coast.[117] This suggests that the fish appear off southern Peru several months before appearing in oceanic waters to the west and off Ecuador to the north. Yields in the offshore fishery off southern Peru out to 120-140°W appear to improve in October and last through January.[118] This pattern correlates with available data on Chilean catches which generally begin to decline after August along the country's central coast. Chilean catches subsequently do not become significant again until March (Chile, appendix E2c1).[119]

F. Sizes

The authors have no statistical data on the sizes of swordfish harvested off Peru. The recreational fishermen active in the 1950s reported small swordfish off Peru.[120] The population was, however, not limited to small fish. There have also been large swordfish taken off Peru. One U.S. recreational fisherman active in Peru during the 1940-50s reports that artisanal fishermen landed a 680-kilograms (kg) fish in 1941. Another U.S. recreational fishermen reported that he saw the biggest swordfish he ever encountered. The fish were feeding off Cabo Blanco during the 1940s.[121] One report of the artisanal landings during the late 1940s at the peak of the fishery indicated that the fish being landed averaged about 135-180 kg which yielded trunks of over 100 kilograms.[122] Currently observers have noted the presence of small, juvenile swordfish off Peru, especially on the Nazca Ridge.[123] The authors have no data on the sizes of fish being taken by Peruvian and Japanese fishermen. One report suggests that the Spanish have been taking large quantities of juvenile swordfish and transshipping them through Ilo.[124] One of the areas targeted by the Spanish is reportedly the Nazca Ridge. An official of the Peruvian company handling the shipments, however, denies the Spanish are transshipping small swordfish. He reports that most of the swordfish are 80-320 kg, but some are as small as 20 kilograms.[125] The authors have no independent data to assess these conflicting reports. Given that the Spanish conduct extensive operations off Chile, the size distribution of the catch may be similar to that reported by Chilean longline fishermen.[126]

G. Feeding behavior

Swordfish feeding behavior off Peru is not well documented. Some work has been done on feeding behavior in the north Pacific, but virtually none in the southeastern Pacific.[127] Information is only available on feeding activity off the northern coast and it is limited to anecdotal reports from sport fishermen during the early 1950s. The authors know of no recent Peruvian studies.

Northern coast: Swordfish off northern Peru may feed primarily on squid, although only limited information is available to support this thesis. One sport fisherman in 1951 reportedly examined the stomach contents of 50 swordfish, and found that all contained squid and only one included a bonito.[128] As the sport fishery was conducted primarily off the northern coast, these observations were almost entirely from fish taken out of Cabo Blanco. Peru's squid resource occurs primarily off the northern coast. While highly variable, a substantial resource does appear to exist. Catches, mostly by foreign fishermen, have approached 200,000 t (appendix B7b1-2). Such a resource could support a substantial swordfish population.

Southern coast: The authors know of no observations as to the stomach contents of swordfish taken off the southern coast. Adult swordfish off southern Peru may feed on squid, jack mackerel, horse mackerel, and a variety of other species as appears to be the case off Chile.[129] Commercial fishermen on offshore grounds off Chile report finding squid as the primary species in stomach contents assessments off the coast.[130] At least one study shows jack mackerel and demersal finfish may be more important in the fish taken by artisanal fishermen along the central coast (Chile, appendix B2a). There does not seem to be an important squid resource off either southern Peru or Chile.[131] The swordfish may, however, simply be better at finding the species than the fishermen who do not target it. But such assessments of feeding behavior off Peru are pure conjecture at this stage. The large juvenile population on the Nazca Ridge may be related to the abundance of crustaceans (lobsters and crabs) and squid in the relatively shallow water (300-1,000 meters). These species appear to be preferred prey items for juveniles (individuals from 15-30 kg).[132]

The different seasonal patterns off northern and southern Peru may reflect differing prey species or stocks. Notably the squid fishery off Peru, a primary prey item, is conducted primarily along the northern coast.[133] Most of the domestic catch has

traditionally been landed there (figure 11). The foreign fishery is also conducted there. In addition, historical Japanese swordfish yields along the northern coast appear to be somewhat higher from August through December, although there are some other months with high yields.[134] This also appears to roughly correspond with the squid catch which in 1991-92 began to increase in June, but was highest from September through December (appendix B7a).[135] If squid catch data reflects actual distribution it could partially explain why swordfish migratory patterns appear to be different off the northern coast--although more data is needed to establish a valid statistical connection. IMARPE reports that the squid resource off Peru fluctuates sharply from year to year as a result of temperature variations. Particularly good squid catches are reported when the water off northern Peru warms during El Niño years, perhaps explaining why swordfish catches can also increase.

H. Stock status

The authors have no actual data on the status of swordfish stocks off Peru, nor is the relationship between swordfish off the other Pacific-coast South American countries and adjacent oceanic areas known. This makes possible stock assessment work problematical. (See "Stock structure" above.) The size of the resource and status of the stock is simply unknown.

Peru may have a substantial swordfish resource. There is no stock assessment data, but catch data provides some indicators. Current Peruvian catches are minimal, but this does not mean that the species is not present in commercial quantities as foreign fishermen are taking the species.

Previous catch: Peruvian fishermen reported swordfish catches of about 2,500 t during the 1950s, and some estimates suggest much higher catches of nearly 7,000 t (appendix B2a and figure 16). (See "Catch".) The fact that such a large catch was previously report does not mean a large stock currently exists, but it does suggest the possibility of such a stock.

Current catch:The minimal current catches appear may primarily reflect a lack of domestic fishing effort, rather than an absence of fish. Foreign fishermen report catches within and outside the country's 200-mile coastal zone, substantiating that swordfish is present in commercial quantities. It is possible that climatic changes may have impacted the abundance and distribution of the species and the large catches reported during 1947-52 are no longer possible.

Valid stock assessment studies require extensive data collection and sophisticated analysis of the collected information. Often such work is not possible because of budgetary limitations. This is a particular problem in developing countries. The authors have been unable to identify any Peruvian research on swordfish addressing stocks or describing the species behavior. As a result, the only indicator available on swordfish abundance is catch data from the fishery. While there are significant problems associated with using fisheries-dependent data (catch and effort statistics) to assess stocks, such data does provide a readily available indicator. When viewed with other information, fisheries data can help assess stock status. When only fisheries-dependent data is available, it must be used with considerable caution. Catch data is an especially good indicator when the fishery is fully utilized, although uncontrolled catches can adversely affect the stock and result in plummeting catches during subsequent years. As Peruvian fishermen do not target swordfish, catches during recent years have been minimal (appendix B2a and B3d1). Assessing the current stock status with Peruvian catch data is thus not possible. Data from other countries involved in the fishery, however, provide some possible indicators as to the status off Peru.

Catch trends in neighboring countries and in offshore areas could provide some insights as to the stock status off Peru, if swordfish in the southeastern Pacific are a single stock. Most of the available catch data from the southeastern Pacific does appear to show a similar pattern of a heavily fished, declining stock:

Neighboring countries: Chilean and Ecuadorean fishermen have been reporting lower catches, although the Ecuadorean pattern is mixed as the fishermen have initiated an expanded fishery on new offshore grounds.

Chile: Detailed data is available on Chilean catches which show a very sharp decline since the fishery peaked in 1991 (Chile, appendix E2a2). Differences exist, however, in the inshore artisanal fishery off the central coast and the offshore commercial fishery off the northern coast (appendices E2h1-2, E3b1, and E4d1). Presumably abundance off southern Peru will be similar to that off northern Chile.

Ecuador: Very little data exists on Ecuadorean catches, but the limited available data also showed a notable catch decline since peaking in 1990-92. A new directed fishery on untapped grounds to the west of the Galápagos, however, have resulted in increased catches since 1995-96 (Ecuador, appendices B2a). Abundance in coastal waters off Ecuador will probably be similar to that off northern Peru.

Japanese assessment: Japanese researchers at the National Far Seas Fisheries Research Laboratory (JFSFRL) have assessed catch and effort data from the Japanese longline fleet since 1952. They caution that swordfish is not the fleet's primary focus and that some swordfish fluctuations may have been caused by changing fishing operations directed at tuna, the primary focus of the fishery. The Japanese researchers have, however, attempted to correct for those problems. They report that the swordfish catch reached record levels in 1992, but that yields have declined since peaking in 1976. Published yields data in 1992 were only about half of those reported in 1976, but well above the very low levels reported in 1983.[136] Japanese researchers in 1994 noted a moderate decline in yields, but not as sharp a decline as reported by the Chileans.[137] Japanese researchers caution, however, that the increasing catch and declining yields may be signaling declining abundance and the fishery should be carefully monitored.[138]

Swordfish stocks are affected by a variety of fishery and non-fishery factors. Catches may, as a result, fluctuate widely from year to year, in some cases irrespective of abundance. The massive decline of the Peruvian fishery from the peak years in the late 1940s and early 1950s are largely unexplained. The decline may have resulted from various climatic, fishery, economic, and other factors. It is unclear if the decline in the catch has reflected a corresponding decline in the available resource or if Peruvian fishermen are just not effectively or intensively targeting the resource. It appears that a substantial swordfish resource is available to Peruvian fishermen, but is not being utilized. A variety of possible factors, however, affect swordfish abundance.

Climatic: U.S. researchers have shown that swordfish fisheries in the north Pacific fluctuate significantly over extended periods as a result of the climatology.[139] Japanese researchers stress that a variety of climatic/oceanographic factors can affect swordfish vulnerability to longlines--irrespective of abundance. Factors include variability in the depth of the fish caused by changes in the vertical thermal structure, oxygen levels, and prey abundance/availability.[140] The authors are unaware of any studies attempting to correlate climatic changes since the 1950s with swordfish abundance off Peru. This subject, however, needs to be assessed in detail. **Fishery**: Both foreign and domestic fishing could be depleting the stock, but the evidence explaining the decline during the 1950s as a result of over-fishing by harpoon fishermen is not convincing. Several other fishery-dependent developments, however, may have impacted the resource.

Coastal over fishing: It is possible that the significant Peruvian and Chilean swordfish fishery during the 1940-50s may have depleted the resource, but given the use of relatively inefficient harpoons, this appears unlikely. Peruvian stocks could have also have been affected by the Chilean directed swordfish fishery which developed during the late 1980s. This fishery at its 1991 peak was harvesting more than 7,000 t of swordfish annually.[141] This level of effort, including longliners taking juveniles, combined with the offshore distant-water effort does appear to have reached levels which potentially could affect abundance.

Domestic fishing for fodder species: Peruvian and foreign fisheries target species the swordfish feed on, or species supporting swordfish prey species.

Small pelagics: Peruvian small pelagics fisheries have expanded enormously since the 1950s and may have directly or indirectly altered available fodder populations. While this would not explain

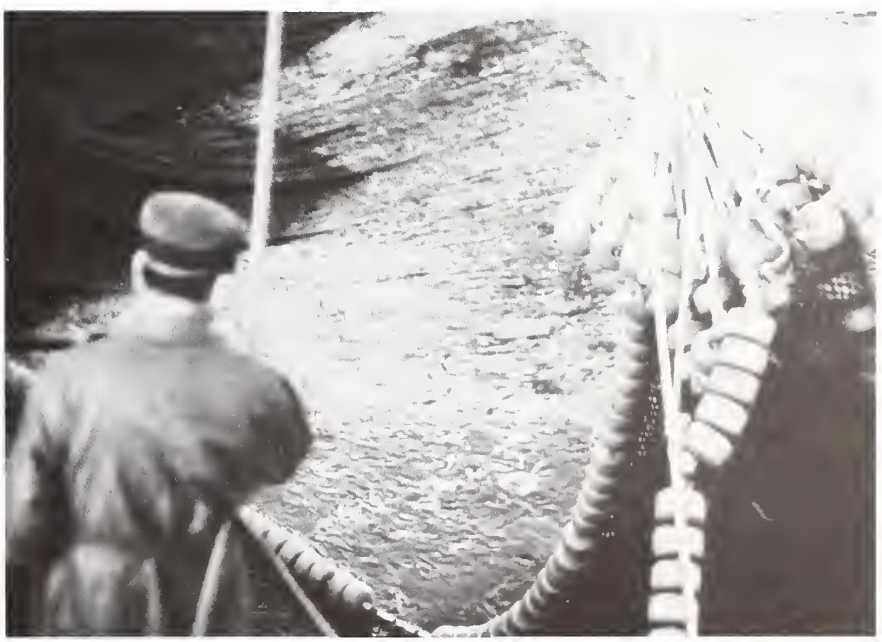


Photo 11.--Massive anchovy harvests since the 1950s may have affected swordfish stocks, but other economic and climatic developments could have also have impacted the Peruvian fishery.

Photo 12.--The fishmeal industry created many new jobs, often paying higher salaries and offering less arduous, safer working conditions then faced by artisanal fishermen. R. Coral

fluctuations during the early-1950s, the small pelagic fishery by the late 1950s was reaching levels which could be affecting stocks of predator species (appendix B1 photo 11).[142] Swordfish catches do not coincide precisely with the overall Peruvian fisheries catch (largely anchovy and other small pelagics). Good swordfish catches (1967-70) have been reported since the Peruvians began harvesting large quantities of small pelagics and swordfish catches have increased in years the small pelagic catch has increased (1967 and 1970). In addition, the swordfish fishery began to decline in the early 1950s before Peruvian fishermen began harvesting large quantities of anchovies (appendices B1 and B2a). In general, however, it can be said that with the exception of a few years around the massive 1972 El Niño event, Peruvian fishermen have not harvested substantial quantities of swordfish since the development of the anchovy reduction fishery in the late 1950s.

Squid: Squid appears to be a preferred prey item for swordfish in many ocean areas. Various squid species are targeted by swordfish. There appears to be a sizeable but highly variable giant squid ("pota") resource off northern Peru. (See "Feeding behavior" above.) Peruvian fishermen have not significantly targeted this resource and until the early 1990s, only small quantities of squid were harvested. The Government began to license foreign jiggers beginning in 1991 and by 1994 catches were approaching 200,000 t (appendix B7a). The development of this fishery could affect stocks of swordfish which formerly preyed upon squid. In addition, natural fluctuations in this highly variable resource could affect swordfish abundance and/or distribution.

Foreign longline fishing: The development of a distant-water tuna/swordfish fishery by Japan and other Asian countries in the 1950s, may have reduced the possible swordfish catch off Peru. The authors note that Japanese longline fishermen since the mid-1960s have reported substantial swordfish catches in the ETP, although they primarily targeted tunas.[143] The Japanese in current years have reported rapidly increasing swordfish catches in the ETP beginning in 1986 (Latin America, appendix C2b).[144] One of their most productive grounds was off southern Peru. This, combined with the Chilean fishery, which was also beginning to report significant catch increases during the late 1980s, could have over-stressed the southeastern Pacific stock.

Economic factors: The decline of the swordfish fishery could also have been due to factors which did not affect abundance. Economic factors such as the fishermen seeking safer, better paying jobs in other fisheries (bonito canning and fishmeal processing factories or as crew aboard anchovy seiners and other commercial fishing vessels) or other economic sectors (mining) may have reduced fishing effort. The focus of Peruvian investors on the new fishmeal industry caused companies to abandon other more difficult and less profitable fisheries (photo 12).[145] Jobs in the bonito fishery began opening up in the 1940s. Many more jobs were created in the anchovy/fishmeal fishery during the late 1950s. This appears to correlate somewhat with the declining swordfish catches by the mid-1950s (appendix B2a).[146]

III. Fishing Grounds

Peru's 3,000 km coastline is one of the most productive in the world. Peruvian waters are not nearly as diverse as those off Chile to the south which has sub-Antarctic conditions along its far southern coast. The oceanographic conditions along much of the Peruvian coast are quite similar, except for the extreme northern coast around Paita (5°s) and Cabo Blanco. Near Ecuador and the Gulf of Guayaquil (3°S) the seasonal intrusion of warm equatorial water and the waning influence of the Humboldt Current create environmental conditions distinct from the rest of the Peruvian coast. In addition, a peninsula juts off from the coast (Punta Negra and Punta Aguja, 6°S) which interacts with converging ocean currents. The distinct topography and oceanography of the far northern coast appears to create ideal conditions for swordfish. Notably, Peruvian fishermen have reported their swordfish catches along the far northern coast.

Peru does not have extensive claims to off-shore islands, unlike Ecuador and Chile. The largest Peruvian island is Islas Lobos de Tierra (60°S, 81°W), just a few kilometers off the northern coast. Thus Peru does not have any important insular claims to jurisdiction extending out into the ETP. The principal underwater feature off Peru is the Nazca Ridge ("Falla de Nazca") which runs southwest from the central Peruvian coast (about 15°S, 77°W) near Pisco and Nazca until it connects with the Sala-y-Gómez Ridge (about 25°S, 85°W) to the west of Chile's Isla San Félix. The Nazca Ridge is important to the southeastern Pacific swordfish population and several observers have noted the presence of juvenile swordfish throughout the year. Their presence appears to be related to feeding. (See "Feeding behavior" above.)

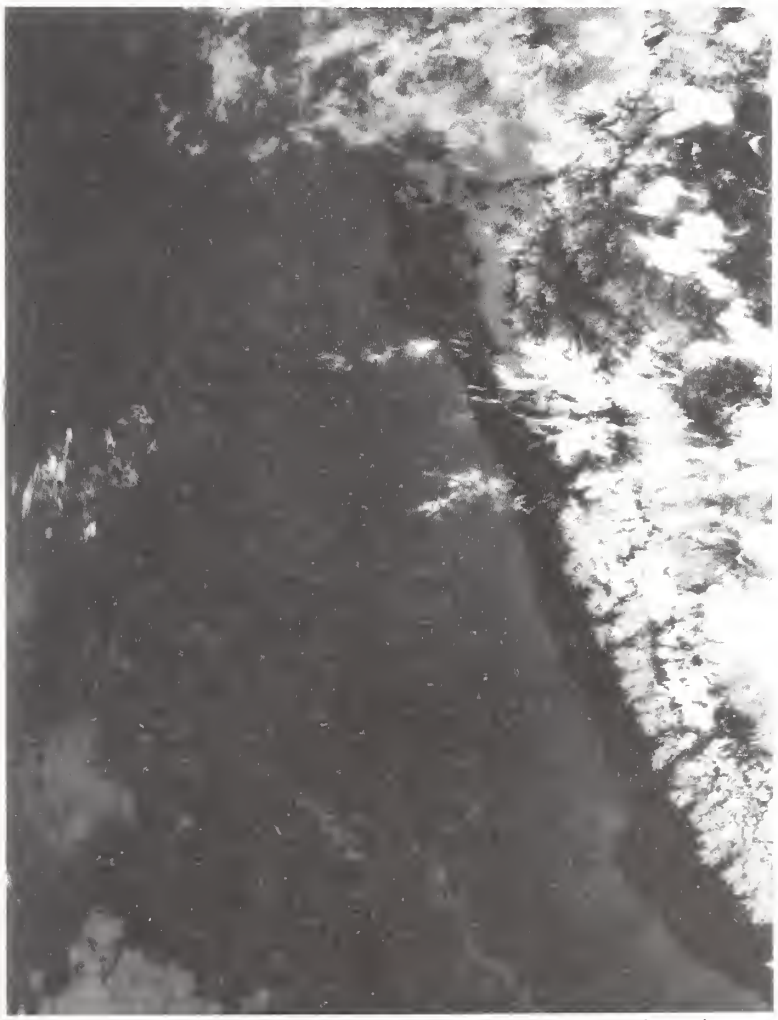


***Photo 13**.--The light colored areas along the Peruvian coast indicates the cooler water associated with the Humboldt Current and coastal upwelling. NESDIS/NOAA*

The Continental Shelf is narrow along most of the Peruvian coast. Along the southern coast the shelf is especially narrow, extending only about 25 km from shore. Along the central coast off Chimbote, Trujillo, and Chiclayo (7-10°S) and off Callao (12°S) the shelf broadens, at times approaching 100 kilometers. The sea floor beyond the narrow continental shelf drops sharply into the Peru-Chile Trench to depths of 6,000-6,300 m off Peru and over 8,000 m off northern Chile. This is substantially deeper than depths in the Panama Basin to the north off Panama, Colombia, and northern Ecuador where there is more shallow water of only about 2,500-3,700 meters.

High fisheries productivity off Peru is largely attributed to the movements of oceanic water masses and to associated changes caused by prevailing winds. **Humboldt Current**: In the southeastern Pacific south of 45°S off Chile's far southern coast, there is a net eastward movement of water. This movement is caused by the West Wind Drift and rotation of the earth (Chile, figure 62). The surface current transported east is rich in plankton and approaches the Chilean coast at about 50°S where it divides. A southern branch flows southeast around Cape Horn. The other branch becomes the Humboldt or

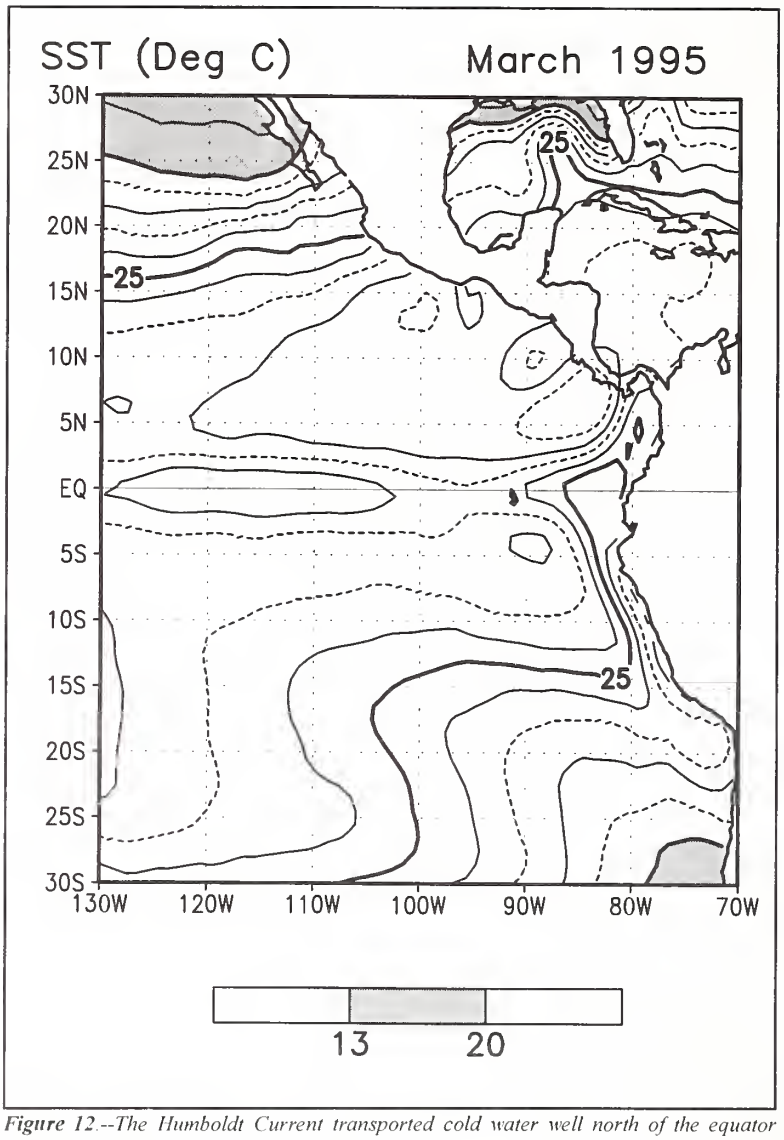


Figure 12.--The Humboldt Current transported cold water well north of the equator during March 1995. Vernon Kousky/NOAA

Chile/Peru Current which flows northward along the Chilean and Peruvian coast.[147] The Current is sufficiently powerful to lower sea surface temperatures (SSTs) along the Pacific coast of South America several degrees from the zonal average.[148] Its effect is normally felt seasonally as far north as Ecuador (figure 12). The Humboldt Current appears to have a major impact on temperatures, especially at depths from 30-125 meters.[149] The area off the northern coast around Cabo Blanco, near the Ecuadorean border, is often a major mixing area between the northward flowing Humboldt Current and the eastward flowing South Equatorial Counter Current. It is thus not by accident that several world record game fish have been taken on the grounds off Cabo Blanco. Peruvian coastal waters are dominated by this northerly flowing cold Humboldt Current. Thus relatively cold water temperatures can be noted at equatorial latitudes, creating pronounced thermal fronts which are often associated with swordfish (figures 12 and 13). The impact of the Humboldt Current partially explains why Peru is the only country harvesting several million tons of fish at tropical latitudes.

Upwelling: Embedded in the Humboldt Current is a strong upwelling circulation which lowers the temperature of coastal waters (within 100 km from the coast), already affected by the cold Humboldt Current, another 2-4°C (photo 13).[150] At various locations along the Peruvian coast, southerly and southeasterly winds carry surface waters away from the coast, setting up vertical currents drawing up colder waters from moderate depths toward the surface, a process known as upwelling. Coastal areas affected by upwelling are some of the richest fishing grounds in the world. Upwelling systems provide optimal conditions for primary productivity. The colder upwelled water, rich in nutrients, enhances the growth of plant plankton which is the basis for the abundance of marine resources off Peru.[151] The upwelling system off Peru and Chile is the most productive in the world.[152] This explains why Peru, a country with very limited shelf area, has produced nearly 13 million t of fish in a single year (appendix B1) and is consistently one of the leading fishing countries in the world. The upwelling zone off Peru extends all along the Peruvian coast, from the Chilean border north to the Ecuadorean border.

Swordfish abundance off Peru appears to be affected by both thermal fronts and currents as well as underwater topography. There is a strong relationship between the abundance of oceanic predators and thermal fronts along the Chilean and Peruvian coast. The high productivity of the frontal zones has long been understood by fishermen. One observer reporting during the peak of the recreational fishery in the early 1950s, maintained that the occurrence of swordfish was related to action of the cold, northerly flowing Humboldt current.[153] Giant squid, anchovy, and dinoflagellate blooms are abundant in these fronts, thus attracting swordfish and other pelagic predators.[154] The Nazca Ridge, the principal submarine feature off Peru, appears to offer a suitable habitat for juvenile swordfish.

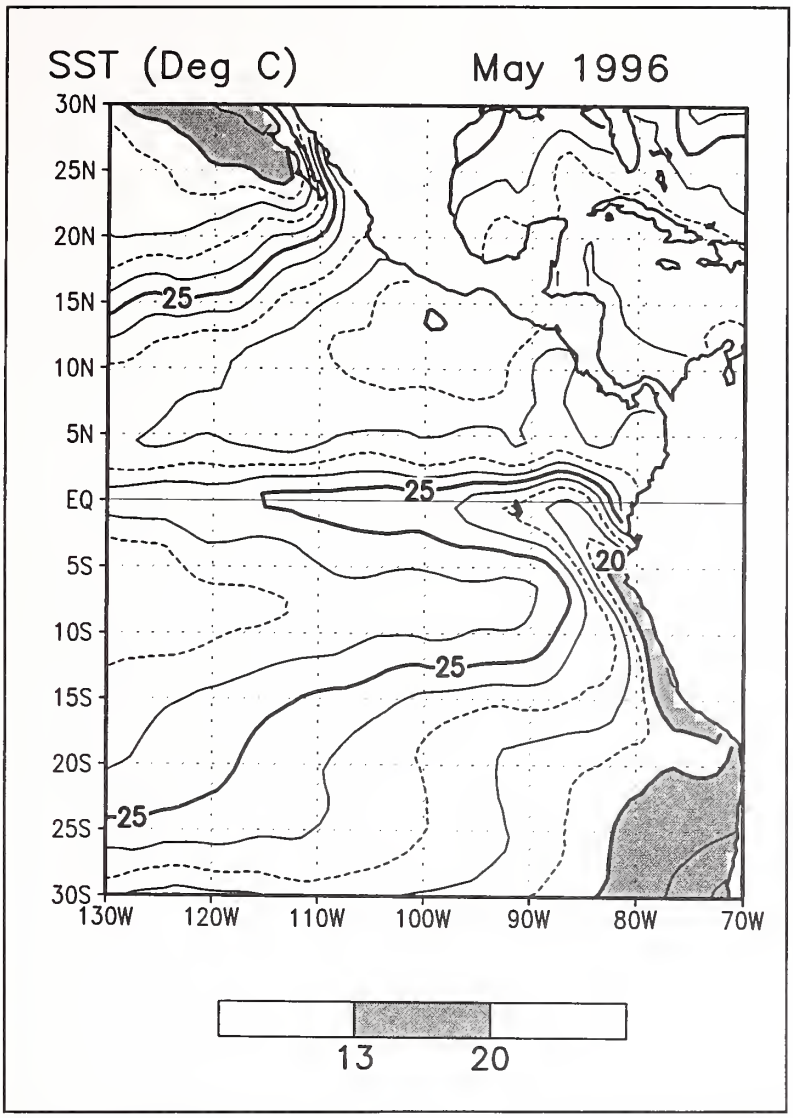


Figure 13.--The Humboldt Current can influence temperatures and help create thermal fronts well out into oceanic areas of the eastern Pacific as it did during May 1996. Vernon Kousky/NOAA

Peruvian domestic swordfish catches have historically been reported primarily off the northern coast, but foreign fishermen have reported the highest catches and yields off the southern coast. Limited directed swordfish fishing in 1997 is reporting the best catches off the southern coast, but this may be, at least in part, the impact of the developing 1997 El Niño (appendix B8a1).

Northern coast: Peruvian fishermen during the 1940-50s and in the early 1970s reported significant swordfish catches, mostly off the country's northern coast (appendices B3a2, B3b2, B3c2, B3d2 and figures 5 and 6). The best fishing in the north was reportedly off Cabo Blanco (between Máncora and Paita). This area is just north of an area where the Peruvian coast juts out into the ocean, deflecting the flow of the Humboldt Current. Reports suggest that the Peruvian fishermen during the 1950s conducted operations from 50-400 km off the coast, depending on the autonomy of their vessel.[155] Directed swordfish trials in 1997 have reported very poor results off the northern coast (appendix B8a1), but effort is very limited and the warm water temperatures resulting from El Niño may be affecting results, making it impossible to draw any conclusions on possible abundance at this time.

Southern coast: Peruvian fishermen during the 1950-60s, reported limited fishing off the extreme southern coast near the Chilean border. The best southern fishing during the 1950s was reportedly off Mollendo and Ilo.[156] Peruvian fishermen initiating operations in 1997 are reporting good results off the southern coast (appendix B8a1). Foreign fishermen have been active in the south. Currently much of the activity for swordfish in the south is conducted by the Spanish out of Ilo. As they do not have Peruvian licenses, the Spanish fishermen are reportedly fishing outside the 200-mile limit off both Peru and Chile. One of their grounds is reportedly the Nazca Ridge, which is partly beyond Peru and Chile's 200-mile zones. The Nazca Ridge extends southwest from the southern Peruvian coast south of Pisco (about 15°S) into the Pacific Ocean (as far south as 24°S). The Ridge begins in Peruvian waters; the southern area is mostly in international waters where it intersects with the Sala y Gómez Ridge to the west of Chile's Isla San Félix. Swordfish are reportedly abundant on the Ridge, but are mostly juveniles.[157]

Foreign fishermen targeting tuna and swordfish in recent years have been more active off Peru than Peruvian domestic fishermen. Japanese longline fishermen have also reported substantial catches on and to the west of the Nazca Ridge, as far south as 25°S.[158] Chilean and Peruvian sources confirm that the Spanish fish extensively off southern Peru and northern and central Chile, outside of the 200-mile limit. The grounds they have targeted are discussed in more detail under "Species: Distribution" above.

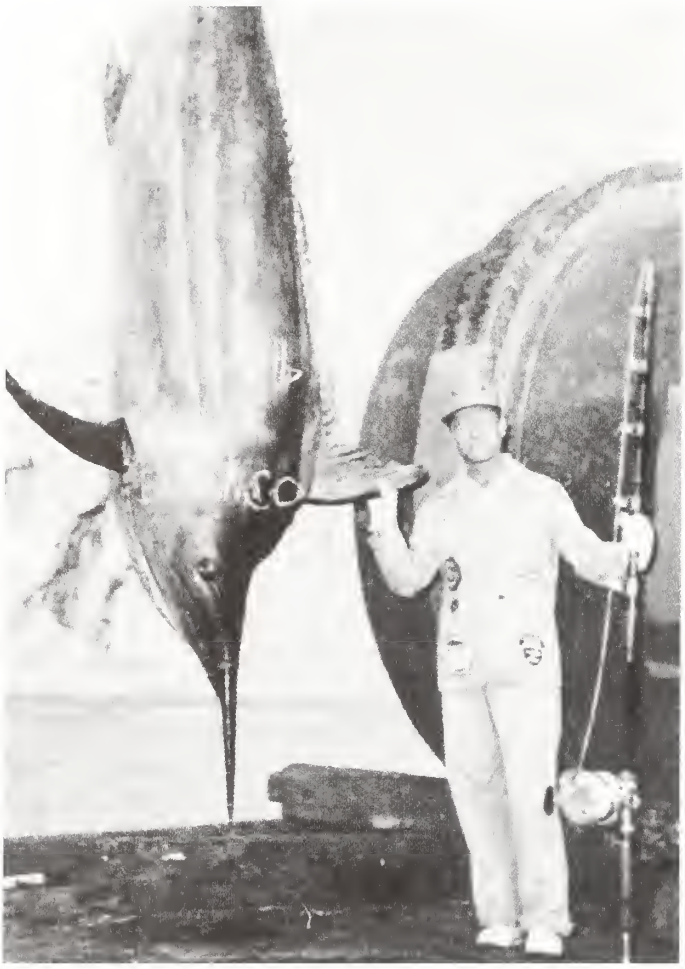


***Photo 14**--Foreign recreational fishermen reported considerable success with swordfish off Cabo Blanco during the early 1950s.*

Peruvian waters have been described as a sport fisherman's paradise. One noted sport fishermen writing in the 1950s described Peruvian waters, especially off Cabo Blanco, as the only place in the world that an angler can take swordfish and black marlin--the largest game species. He also described Cabo Blanco as the location where the greatest number of other game fish (especially striped marlin, sailfish, mako sharks, bigeye tuna, and many other species) can be taken virtually year-round (photo 14). Swordfish in the 1950s could reportedly be found extremely close to the coast, only about 8-13 kilometers. The swordfish were found especially close to the coast during the Peruvian winter (July-September).[159]

IV. Fleet

Peruvian commercial and artisanal fishermen deploy one of the largest fishing fleets in Latin America. The commercial fleet is primarily a fleet od small seiners focusing on small pelagics and some trawlers targeting hake. It does not report a swordfish by-catch. The artisanal fleet is composed of a wide range of vessels and in recent years has reported a small swordfish by-catch.

Peru's commercial fishing fleet is composed of more than 700 well-equipped small seiners ("bolicheras") primarily targeting anchovy and sardines. The vessels vary greatly with holds ranging from 35-600 m^3 and deploying seines ranging from 290-920 m in length and 42-130 m in depth. The small trawl fleet primarily targets hake along the northern coast and is composed of modified seiners. The trawlers have holds varying from 35-300 m^3 and engines from 300-1,100 HP. A few factory vessels are deployed by joint ventures.[160] Various groups have attempted to deploy tuna purse seiners and longliners, but without success.

Peruvian artisanal fishermen are now mostly motorized and deploy various types of lines with virtually no swordfish by-catch. The artisanal fishermen, unlike the commercial fishermen in recent years have reported a small swordfish by-catch. Some artisanal fishermen deploy small longlines and are conducting semi-commercial operations, primarily for shark and dorado. The commercial fishermen continue to focus primarily on small seiners taking anchovy and other small pelagics. As with the artisanal fishery, there is virtually no swordfish by-catch, although factory trawlers have reported some swordfish by-catch. Peruvian companies have had little success in deploying commercial longliners for tuna and swordfish. Companies are now attempting to deploy a few longliners to deliver high quality fresh and frozen product, but results have been mixed.

A. Peruvian domestic fleet

1. Fleet overview

Peru in the mid-1980s reported about 12,000 artisanal fishermen deploying nearly 4,500 small boats. More recent accounts suggest about 5,000 artisanal boats are active (photo 15). More than 90 percent of those vessels by the 1980s were motorized. A variety of vessel types are active, including a few semi-commercial longliners operate off the northern coast.

Palangeros (longliners): Peru's artisanal surface longline fleet is based in northern Peru. This is the most advanced sector of the artisanal fleet and could be classified as semi-commercial. The authors have received varying accounts about the number and size of the vessels involved. One report describes a fleet of about 30 vessels ranging from 8-18 m based in Paita (photo 16).[161] Another observer describes a fleet of about 100 vessels operating out of ports from Cuboid north to the Ecuadorean border, but primarily Paita. They are about 20-m long with wooden hulls and ice holds of 10 tons. Almost all have diesel motors, but there are still a few sailboats.[162]

***Photo 15**.--A wide range of vessels are deployed by artisanal fishermen at villages located all along the coast.*

Photo 16.--A Peruvian longliner which lands fresh fish, but not export-grade product. Robert Webster

Photo 17.--Artisanal fishermen deploy many different types of small boats, both decked and undecked, which utilize a wide variety of gear. Robert Webster

Photo 18 *--A small open boat fishing out of Matarani which is used to deploy longlines targeting sharks. Eduardo Pastor*

Photo 19.--Peruvian fishermen used to deploy large numbers of balsa rafts, many in the swordfish industry, but the rafts are now becoming increasingly less common. D. Weidner

Cortineros: These vessels vary from 6-8 m with motors of 25-45 horsepower. There appear to be three classes of these boats, varying by hold size: San José (1.0-1.5 t), San Andrés (1.5 t), and Callao (2-4 t). The vessels have crews of two to three persons, except for the larger Callao class which averages about 5 crew members. They deploy a variety of gear (photo 17).

Pinteras: Most of the pinteras are San José-type vessels, usually about 5-7 m long and often called "botes". A smaller number are under 5 m and referred to as "chalanas". Hold capacity varies from 1.0-1.5 tons. These vessels deploy a variety of gear (photo 17). A few of these small open boats also deploy longlines (photo 18).

Extractor: These larger boats are used in fisheries requiring divers and are generally 7-11 m long. Their holds vary from 1-3 tons.

Multipurpose: These small motorized seiners are often San Andrés, or Callao-type boats, usually from 10-12 m long. Holds range from 4-8 tons. Besides seines they also deploy gillnets ("redes agalleras") of different mesh. Depending on the species targeted, the fishermen refer to these nets as ("cojinoveras," "boniteras," and "macheteras," etc).[163]

Balsillas: Balsa rafts are composed of about 5 balsa logs. Most are about 2.5-3.8 m long. There is no hold and propulsion is by oars and sails.[164] Some are deployed from larger artisanal vessels (photo 19).

The Peruvian commercial fishing fleet focuses primarily on the country's enormous small pelagic resources. Massive quantities of anchovy, mackerel, and sardines are harvested by a large fleet of seiners ("bolicheras") for reduction to fishmeal, or to a lesser extent canning (photos 20 and 21). These purse seiners harvesting both to supply reduction and seafood plants constitute more than 80 percent of the fleet (appendix A1 and figure 14). Government and private groups have shown some interest in diversifying the fleet. State corporations have attempted to do so, but with little success. Now with the current Government's emphasis on private enterprise, several private companies have begun to expand fleet operations. One report indicates that private companies have invested more than $400 million during recent years in new plants and vessels. Much of this has gone into modernizing the fishmeal industry (photo 22).[165] Some of the investments are, however, going into operations producing edible products.[166] Several companies have launched new projects and others are under consideration. One U.S. consulting group has recently made a number of suggestions, including acquiring longliners and gillnetters capable of offshore operations.[167] Such operations could result in expanded tuna catches as well as the revival of the swordfish fishery.

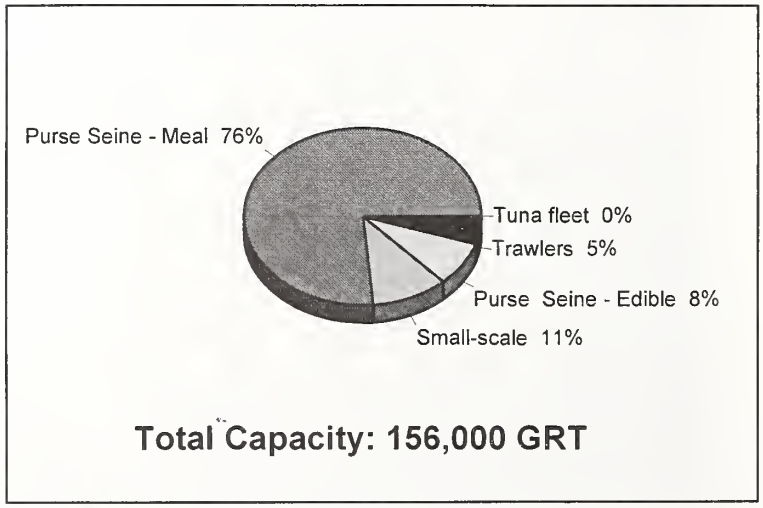


Figure 14.--The great bulk of Peru's fishing fleet is still small purse seiners which land small pelagics for reduction to fishmeal.

Photo 20.--Peruvian companies have added many new seiners to the fleet in recent years. Robert Webster

Photo 21.--Peruvian companies during the 1990s have reported catches approaching the record set in the early 1970s, but the catch is reportedly lower in 1997. Eduardo Pastor

Photo 22.--Private Peruvian companies like SIPESA have made major investments in the fishmeal industry during the 1990s. Eduardo Pastor

Peruvian companies have achieved minimal success in deploying commercial longliners in pelagic fisheries. Some companies have had a degree of success with demersal longlining, but pelagic operations have proven more difficult. The new vessels acquired during the 1990s allowed fishermen to increase exports of high-quality fresh ocean pelagics for the United States to nearly $190,000 in 1994, but shipments have since fallen back to only $50,000 in 1996 (appendix E2c). Efforts to pursue pelagic longlining continue, despite some notable failures. One company's (Consorcio Pesquero) plans in 1995 to produce high-quality sashimi-grade exports have been cancelled, but another company (Sindicato Pesquero) plans to initiate directed swordfish operations in 1997. (See "Companies" for details.)

2. Tuna/swordfish vessels

Peruvian fishermen have operated three types of vessels reporting swordfish catches. Peru's directed swordfish catches during the 1940s-50s were taken almost entirely by artisanal harpoon vessels. During the 1970s the harpoon fishery declined and the gear is no longer authorized by the Government. This ended the directed swordfish fishery in Peru. Small longliners and, to a lesser extent, gillnet vessels currently take most of the limited incidental swordfish catch.

Harpoon vessels: Peruvian fishermen have primarily used harpoons in a directed swordfish fishery. Many vessels were converted from other fisheries and varied substantially in design and size. Most were small boats of about 6-13 m with a plank extending over the bow to enable the harpooner to get a good strike. Initially many of the vessels did not have motors, but used sails. Crews of about three fishermen were common. The last significant harpoon fishing occurred during the early 1970s. One 1996 report indicated that Peruvian fishermen no longer operate harpoon vessels as the gear is now prohibited.[168]

Trolling: A few artisanal fishermen troll for pelagic species, including bigeye tuna and jack mackerel. Swordfish are rarely taken.[169]

Longliners: Peru's small longline fleet reports limited swordfish catches, mostly incidental to tuna catches. Peruvian fishermen have mostly deployed artisanal longliners, but three companies reportedly acquired a few large commercial longliners during the 1990s. The vessels have not, however, successfully deployed in pelagic fisheries landing fresh or frozen product.[170] Peruvian companies in 1996-97 have deployed a few small longliners in an effort to land high-quality fresh product.

Artisanal: Artisanal fishermen deploy small surface longliners, varying from 8-20 meters (photo 23). These longliners are generally poorly equipped and even lack hydraulic power to bring in the line. They land fresh product, which is rarely high-quality export grade.

Commercial: There are only a small number of large fishing vessels in the Peruvian fleet.[171] Accounts on the number of commercial longliners vary and several

Photo 23.--A small artisanal longliner operating out of Matarani. Eduardo Pastor

vessels have been acquired and sold in recent years (appendix A2).

Fresh fish: One observer in 1990 reported that Peru had five modern longline vessels, but only the vessel owned by a single private company was operational.[172] A more recent observer reported three tuna longliners.[173] The fishermen have generally had more success with bottom longlining for demersal species than pelagic longlining. These longliners average about 18 meters. They have fairly limited ranges of about 10 days, primarily because they use ice holds and are not equipped with refrigeration. Peruvian companies in recent years have added a few small longliners to the fleet. At least one company (Sindicato Pesquero) in 1997 was planning directed swordfish operations with newly-built 20-m longliners.

Frozen fish: Three companies in the 1990s have attempted to use large commercial longliners to produce high-quality frozen fish. Consorcio Pesquero operated two large (25 and 90 m) freezer longliners in 1996 (appendix A2). The vessels were both capable of extended voyages of up to 4-6 months.[174] The vessels were sold in 1996-97, one to a foreign company and the other to Cazamar.[175] Tuna Latin attempted to use Japanese longliners. Pesquera Atlantis also is attempting to use Japanese longliners during 1996-97. A 50-m longliner donated to the Universidad Nacional de Piura (UNP) was idled in port during 1996 (appendix A2). No current details are available.

Gillnetters: Artisanal fishermen operate a variety of small boats deploying gillnets. Like the artisanal longliners, these boats are generally from 6-10 m long and poorly equipped.[176]

Details on the Peruvian commercial longline fleet are as follows (appendix A2):

Andrew: Pesquera Atlantis purchased this 23-m squid jigger in Japan during late 1995 and refitted it for longlining.

Audaz: This 18-m longliner has been deployed by Sindicato Pesquero in the bottom longline fishery for seabass.

Audaz 1: This 20-m longliner was being constructed in 1997 at the Transmar Luz shipyard for Sindicato Pesquero.

Christopher: Pesquera Atlantis purchased this 23-m squid jigger in Japan during late 1995 and refitted it for longlining.

Eraz I: This 14-m longliner is a fresh-fish vessel and is equipped with an 8-t ice hold. It was launched in July 1996. It is owned by an individual associated with Trabajos Marítimos, S.A. (TRAMARSA) and other associated investors. The vessel is the first Peruvian-built longliner. (See: "Shipyards.") It has primarily been used in demersal fisheries, but the owners are redeploying it for oceanic pelagics as a result of the warming water temperatures beginning in mid-1997.[177]

Ibaraki: This Japanese freezer longliner was donated to the Universidad Nacional de Piura in 1994 for test fishing. Efforts to use the vessel were reportedly unsuccessful. One July 1996 report indicated that the vessel was idled in port because of a lack of funds. As of mid-1997 it was still laid up in port. (See: "Research.")

Inca Mar: Tuna Latin acquired the *Inca Mar* in 1980 and has attempted to deploy it in tuna/swordfish operations. The ventures have proven unsuccessful and this large 300-GRT longliner is currently used as a floating cold store by Tuna Latin (photo 53). (See: "Companies.")

Juliana: This small 6-m longliner was reported abandoned and adrift off Ecuador in 1992. It was owned by a U.K. national (Peter Sucksmith) resident in Peru. No further details are available.

María José: This 25-m freezer vessel was operated by Consorcio Pesquero from 1993-96. The company had hoped to produce sashimi-grade tuna and swordfish. Operations, however, proved disappointing. (See: "Companies.") The vessel was sold to Cazamar in 1997.[178]

Paloma: This 90-m longliner is the largest longliner currently operated by a Peruvian company, Consorcio Pesquero. (See: "Companies.") The vessel is registered in Panama. It was sold to a foreign company in 1997.[179]

Pena Cayetano: This steel hull longliner is 17 m long with a draft of 2.9 meters. It is usually deployed on voyages of about 10 days delivering fresh fish. It has an ice hold and no freezing capability. The vessel has a 10-man crew.

Pionero: This 18-m longliner has been deployed by Sindicato Pesquero in the bottom longline fishery for seabass.

Pionero 1: This 20-m longliner was being constructed in 1997 at the Transmar Luz shipyard for Sindicato Pesquero.

Rossie: Pesquera Atlantis purchased this 23-m squid jigger in Japan during late 1995 and refitted it for longlining.

SIPESA: This 80-GRT longliner is 18 m long with a draft of 4 meters. The vessel has a steel hull and usually conducts 10-day trips with about 5 days on the fishing grounds. It has an ice hold for fresh fish, but no freezing capability. The vessel is operated by a 14-man crew.

Triunfador: This 20-m longliner was being constructed in 1997 at the Transmar Luz shipyard for

Sindicato Pesquero.

Others: Several small artisanal longliners and small commercial longliners landing fresh product reportedly operate under contract to companies in Paita (such as Agro-Pesca). These fishermen tend to harvest primarily shark and dorado. Few details, however, are currently available.

3. Recreational fleet

Foreign fishermen were active during the 1930-50s in an effort to develop recreational fishing.[180] A fishing club was organized in the 1950s which acquired some vessels.[181] Anglers reported some record catches and journalists wrote glowing accounts of fishing off Peru, especially off Cabo Blanco. The recreational fishing industry and fleet, however, never developed. It is unclear why the industry failed to develop. (See "Fleet Operations and Gear".) The authors have obtained little current information on the recreational fleet. As of January 1997 one report noted a few boats active along the northern coast at Cabo Blanco near Piura.[182] One boat operator has a 7-m wooden boat and he reports that two other boats are active. Local observers report that the lack of foreign participation has made it impossible to develop the industry and to acquire larger, more modern boats.[183] Some recreational boats also operate from the La Punta Yacht Club in Callao.[184] A few other hotels and tour operators offer a variety of boats for inshore fishing, but they do not have the high-powered vessels needed to target billfish.[185]

B. Foreign fleet

Foreign fishermen have deployed longliners for Pacific operations off Peru and neighboring countries:

Japan: Most of the foreign longliners operating off Peru are modern Japanese vessels (appendix A2).[186] The foreign longliners fishing with Peruvian licenses in 1995 were all large Japanese freezer longliners, about 100-120 m in length.[187]

Spain: The Spanish have deployed a relatively small number of longliners in the Pacific off Chile and Peru (appendix A2).[188] Only limited information is available on the vessels as the owners involved have proven difficult to contact and hesitant to discuss their vessels and operations. The vessels reportedly range in size from about 170-500 GRT, although most fall into the 170-300 GRT category. One of the vessels, the *Maicoa*, is relatively large for a Spanish vessel. It is 36-m long and totals 400-500 GRT.[189] It has -60°C blast tunnels and a 185 t hold capacity capable of maintaining the catch at -30°C. The *Maicoa I* is even larger, at about 550 GRT (photo 24).[190]

***Photo 24**.--Several Spanish longliners like the Maicoa I have been active in the southeast Pacific during the 1990s. José Echandía Zegarra*

V. Shipyards

Peruvian shipyards have one of Latin America's greatest capabilities to build fishing vessels. Peruvian yards, however, have focused primarily on building relatively small seiners ("bolicheras") for the country's massive fishmeal reduction fishery (appendix A5).[191] As a result of spectacular 1994-96 results in the small pelagic fishery, Peruvian shipyards have reportedly been very busy.[192] The yards received many new orders for fishing vessels, especially seiners, and have expanded operations and steadily increased the sizes of the vessels they are building (South America, appendix A4). At least one yard has the capacity to build large seiners that can target offshore mackerel resources.[193] SIMA is, for example, currently building seiners with hold capacities of 900 tons. SIMA has also worked on a large 1,000-ton tuna purse seiner originally purchased in the 1970s for tuna. It is currently being refitted to catch jack mackerel in an offshore fishery. Most of the Peruvian construction, however, is seiners in the 300-600 ton range designed for coastal operations. Larger seiners for offshore operations are often imported from Chile (Latin America, appendix A4). In addition, to the larger shipyards, many smaller yards service commercial fishing vessels (photo 25).

***Photo 25**--Small shipyards, like this one at Tierra Colorado in Paita, service small commercial fishing vessels at many Peruvian ports. Eduardo Pastor*

The major Peruvian shipyards have reported considerable activity since 1994. Almost all of the activity has focused on small pelagic seiners to supply canneries and fishmeal plants. However, some activity to supply a few small vessels designed to deliver edible fresh fish has also been reported. Activity as of late 1995 and early 1996 at the major Peruvian yards included:

Andesa: 8 commercial fishing vessels, varying from 350-500 tons.

Navinsa: 12 commercial fishing vessels, varying from 350-750 tons. The shipyard reports that as of January 1996, two 310-ton seiners were ready for delivery and 10 others were in various stages of development.[194]

Remesa: 13 commercial fishing vessels, varying from 350-550 tons.

SIMA: 10 commercial fishing vessels, varying from 120-900 tons. SIMA is also building 23 small artisanal boats of about 30 tons. The shipyard in late 1996 began construction on the first Peruvian seiner to carry a spotter helicopter.[195]

Shipyard representatives in early 1997 reported that had a backlog of orders. Many believe, however, that the Government is planning to restrict further expansion of fishing effort so future orders may be limited.[196] Any decline in the 1997 catch would curtail orders.

Peruvian yards have no experience in building modern longliners or gillnetters that could be employed in the swordfish fishery. One shipyard official reported that no Peruvian yards were building longliners in 1995.[197] Various recent accounts indicate some scattered activity in 1996-97:

Astilleros Ilo: An Ilo shipyard (Astilleros Ilo) in 1996 built a small longliner (25 GRT), the *Eraz I* for a group of Peruvian investors associated with TRAMARSA. (See "Companies".) The authors believe that this is Peru's first domestically built longliner. The vessel

is a 14-m, 20-GRT longliner with an 8-t ice hold. It is capable of trips of up to 14 days.[198]

Transmar Luz: This small Callao shipyard in 1997 was building three 20-m longliners (*Audaz I, Pionero 1*, and *Triunfador*) for Sindicato Pesquero. The vessels are to be deployed for swordfish and are equipped with ice holds for fresh product.[199]

All of the larger Peruvian yards have the capacity of building commercial longliners. Even large commercial longliners are smaller than some of the seiners currently under construction. The Peruvian yards would, however, probably have to contract foreign experts experienced with longlining and driftnetting. Domestic yards could theoretically build or refit such vessels once Peruvian fishermen decided to seriously enter the longline fishery and obtained needed financing. The established yards, however, are reluctant to initiate a new product line because of the substantial start-up costs and still unproven domestic demand.

Peruvian shipyards are protected by stiff import duties and taxes. Import duties for foreign-built fishing vessels are currently 15 percent.[200] The importer also faces the standard Peruvian sales tax (Impuesto General de Venta--IGV) of 18 percent. One company which was considering importing foreign-built longliners reports that they would have faced duties and taxes of over 40 percent.[201] Such high duties make it virtually impossible to import longliners even though Peruvian yards have little experience building such vessels. The current tariff regime is thus a major impediment to launching a substantial Peruvian longline fishery.

VI. Fleet Operations and Gear

A. Peruvian fishermen

1. Artisanal and commercial

a. Historical

Peruvian harpoon fishermen off the northern coast during the 1940-50s operated only a few kilometers from their ports. They operated sailboats and a few motorboats. The fishermen often found the fish in the morning, at the surface. Swordfish off Chile and Peru sun at the surface to warm up after feeding in deeper, colder water at night. While basking in the sun, their dorsal fin is exposed out of the water, providing an opportunity to sight the fish and approach for a harpoon strike. The best fishing times were thus usually in the morning. The fishermen often tried to strike the fish with two harpoons as kegs were not used. One observer reported that in the late 1940s-early 50s he observed a fleet of 21 sailboats and 8-9 motor boats operating out of Cabo Blanco. On two occasions they harpooned over 300 swordfish in a single day.[202] The fish were then tended from balsa rafts (photo 26). The fishermen normally made trips of about 8 hours, but carried no ice to maintain the quality of the catch. Ice was not available in the ports at the time, nor were the small harpoon vessels equipped to carry it. The fish were simply stored aboard the usually undecked vessels. Fishermen averaged about four fish per fishing day or about 750 fish per year. The fish averaged about 135-180 kg which yielded trunks over 100 kilograms.[203]

Photo 26.--Peruvian harpoon fishermen in the 1940s-50s used sailboats and then tended their catch to balsa rafts.

b. Current

Since the end of the harpoon fishery there has been no directed Peruvian fishing operations for swordfish. The limited landings are now primarily the incidental landings of other fisheries, primarily artisanal fisheries. There have also been a few unsuccessful efforts to longline tuna which also took swordfish incidentally. There are in 1997, however, some directed swordfish operations using small longliners.

Artisanal: Most of the small billfish catch is taken by artisanal longlines along the northern coast. Fishermen deploying handlines and driftnets will also take an occasional billfish. Swordfish catches during the early and mid 1990s were very rare. The fishermen in mid-1997, however, have been reporting unusually good catches of billfish and swordfish with driftnets and lines very close to shore. Most observers attribute this to the rising water temperatures associated with El Niño (photo 27).[204]

Longlines: Peruvian fishermen until 1997 have not targeted swordfish with longlines. Some of the unsuccessful tuna longline operations tool swordfish, bit it was not the target species. The directed artisanal swordfish operations used harpoons and not longlines. The artisanal or semi-commercial fleet does report minor incidental swordfish catches using longlines of about 5 km and 500 hooks deployed in shallow water no deeper than 100 meters. Operations are conducted up to 80 km offshore, but normally no more than 50 kilometers.[205] Catches are mostly shark (60-70 percent) and dorado (15-20 percent) and the remainder is tuna, sailfish, marlin, and swordfish.[206] Some of the fishermen reportedly target tunas.[207] Observers describe current methods as "crude and ineffective." Net handling systems are mostly done by hand and few boats have hydraulic systems.[208] Little care is given to maintain the quality of the catch and, as a result, the landings are generally not of export grade (photo 54). Shark production exceeded 2,000 t in 1992, but has since declined sharply (appendix C3 and figure 19). The Peruvian shark and ray catch has plummeted in recent years from nearly 27,000 t in 1988 to only 5,000 t in 1994. Fishermen reported a slight increase in 1995 (appendix B5b and figure 26). A few fishermen and university groups are experimenting with more

***Photo 27.**--Artisanal fishermen in June 1997 landed this swordfish and a marlin. Such catches had been rare until water temperatures began warming.*

modern longlines. The catch is landed fresh. The shark fins and mako shark is exported. The blue shark, billfish (including swordfish) and most of the tuna are marketed domestically. A few large tunas (yellowfin and bigeye) are occasionally exported fresh to Japan.[209] SIPESA's longliners deployed in 1997 are the first to target swordfish with longlines. They are using gear and methods developed in Chile and based primarily on Spanish methods. They deliver the catch as fresh product.[210]

Handlines and gillnets: Peruvian gillnetters primarily work out of northern ports, Callao, Chimbote, Paita, and others. The single most important port is Paita The fishermen work coastal waters rarely moving more than 20-30 miles offshore. The nets are set at depths of 30-100 m and left in the water for 12-18 hours. They are then recovered by hand or in some cases with small deck capstan winches. As a result, the fishermen can take up to 6-7 hours to recover a 3-km gillnet. The fish landed is generally of poor quality, inadequate for export markets. Swordfish are rarely taken.[211] Water temperatures have been warming in 1997 and as a result the small artisanal vessels deploying handlines and driftnets have reported increased billfish catches (especially sailfish and marlin) catches. Swordfish are, however, still less commonly taken by these fishermen.[212]

Commercial: Commercial fishermen conduct longline operations landing both fresh and frozen product.

Fresh: Few details are available on the operations of the longline fishermen landing fresh product. One IMARPE report indicates that these vessels are mostly based in Paita and target primarily shark. There appears to be a small incidental swordfish catch totaling about 0.8 t monthly. The fishermen report trips of about 2-days duration. They fish between 100 km to the north of Paita to 65 km to the south of the port (4°20'-5° S), about 50 km from the coast.[213] Peru's first domestically built longliner, the *Eraz I* was added to the fleet in mid-1996. The owners conduct trips of up to 14-days duration. Initial 1996 operations deployed bottom longlines, but the company is shifting to pelagic operations in 1997 because of rising water temperatures.[214] Another company (Sindicato Pesquero) is deploying three new longliners in 1997 for directed swordfish operations (appendix A2).[215]

Frozen: Two companies (Tuna Latin and Consorcio Pesquero) in the 1990s deployed large longliners landing frozen tuna, swordfish, and other oceanic pelagics. (See "Companies".) Tuna Latin had been attempting such operations since the 1980s, but encountered difficulties with Government regulators. Consorcio Pesquero's results were disappointing and the vessels were sold to foreign and domestic buyers in 1997. A new company (Pesquera Atlantis) has attempted operations during 1996-97, but the few details are available on the results.

2. Recreational

The authors have little information on marine recreational fishing off Peru. Foreign sport fishermen were active in the 1930s-50 off both Peru and Chile. The effort centered in Chile, but some activity was also reported off Peru.[216] Swordfish were one of the primary target species off both Chile and Peru. The swordfish were reportedly smaller off Peru, but a wider range of game fish were reported off Peru and sport fishermen were amazed that fishing could be conducted virtually year-round.[217] The first recreational fishing off Peru was reported in 1935 when a Canadian businessman rigged a boat and

***Photo 28**.--Swordfish taken by recreational fishermen in 1997. Recreational fishermen as well as the artisanal and commercial fishermen are benefiting from the warmer temperatures.*

tested the waters off Cabo Blanco. This was followed in 1939 by a U.S. group, including an executive of the then Pan American Grace Airways.[218]

Outdoors journalists as well as companies like Grace, hoping to build traffic, attempted to promote the fishery. One noted angler reported that both the Chilean and artisanal fishermen were "well trained as rod and reel guides and ... are fearless when it comes to handling big fish and handling a boat as she should be handled." The fishermen trolled with baited hooks. The smaller swordfish common off Peru were reportedly more likely to pursue the bait than the larger fish off Chile. Such recreational fishing appears to have been mostly conducted by foreign fishermen. Only a few Peruvians appear to have participated.[219] The interest of the recreational fishermen helped to stimulate the artisanal fishery which developed in the late 1940s and early 50s.

Considerable recreational activity was reported during the early 1950s. The Cabo Blanco Fishing Club had boats operating in 1951 and erected a club house in 1952. Local captains and crews were trained. The first party reportedly took 44 billfish in 10 days. Records for several species were reported (photo 14).[220] Despite the success reported by the recreational fishermen, activity declined after the early 1950s. It is not clear to the authors why the recreational fishery declined. Excellent fishing was being reported. One local observer suggests that the unstable political situation and suspicion toward foreigners on the part of political leaders may have been factors.[221]

Peruvian recreational fishing is currently very limited, but there is some activity. IMARPE reports that an international sports fishing tournament was held in Ilo during 1996.[222] Peruvian officials report that some big game fishing is still possible from Cabo Blanco and two hotels located there cater to anglers. The Cabo Blanco Fishing Club Hotel as of early 1997 was closed for repairs. The Hotel Merlin, however, was open and its owner has a boat available for fishing and provides an experienced fishing guide.[223] Two other boats were also active in 1997 from Cabo Blanco. The fishermen generally troll with baited hooks and lures. The major species taken are striped and black marlin, albacore tuna, and dorado. Swordfish strikes are extremely rare, but the fishermen currently do not pursue fishing strategies specifically directed at swordfish. The Peruvian fishery is not well publicized nor does the coast of Peru offer many modern tourist amenities. As a result, there are currently relatively few foreign anglers participating in the fishery.[224] Peruvian sources suggest that billfish could be targeted in other areas off Peru, but the lack of a developed recreational fishing industry, especially the shortage of boats, provide anglers interested in billfish few opportunities. One American sport fisherman took his boat (*Francesca III*) to Peru in 1997 and operated with Peruvian sports fisherman Juan Raffo. They fished along the northern coast off Máncora and reported excellent catches of stripped marlin as well as plentiful dorado and bigeye tuna.[225] Peruvian officials do report some limited recreational fishing opportunities for other species from Máncora and ports near Lima.[226] Recreational as well as artisanal fishermen in 1997 are reporting particularly good swordfish and sailfish catches. Fishermen from the La Punta Yacht Club, for example, at the end of May 1997 caught a 235 kg

Photo 29.--Spanish longliners targeting swordfish in the southeastern Pacific have primarily operated out of Ilo in southern Peru. José Echeandía Zegarra

swordfish near the Hormigas de Afuera Islands, about 65 km from Callao (photo 28). It is unusual to take swordfish around Callao and the fishermen believe that the appearance of swordfish and billfish is associated with the warming water temperatures in 1997.[227]

B. Foreign fishermen

The authors have only limited information on foreign fleet operations off Peru and neighboring countries.

Japan: The authors have few details on Japanese fleet operations off Peru.[228] The vessels appear to be managed by the Japanese Association of Tuna cooperatives (Nikkatsuren). Nikkatsuren keeps in touch with the vessels through long-range radio transmitters in Mia Perfecture. A few of the Japanese longliners fishing in Peruvian waters were associated with Tuna Latin from 1979-82. Tuna Latin subsequently tried to purchase seven longliners in 1992-93 (appendix A2). (See: "Companies" and "International".) Peruvian fishermen are employed aboard some Japanese vessels. The fishermen are recruited by Servinave. (See: "Companies.") The Japanese report their best coastal swordfish catches in the southeastern Pacific during the 1990s off southern Peru and lesser quantities off northern Peru and Ecuador. Catches along the northcentral coast were minimal. The bulk of the Japanese swordfish catch in the region, however, is taken well beyond the western coast of South America (95°-145°W) at latitudes from Colombia south to Peru (5°N-15°S).[229]

Spain: The Spanish operate freezer longliners, mostly out of the southern port of Ilo (photo 29). Fishing appears to center at latitudes off Chile, but some fishing is reported as far north as Ecuador. (See "Fishing Grounds".) Fishing operations vary somewhat as the vessels involved differ substantially in size. One of the vessels, for example, is only 170-GRT (*Alicante*) while another is 500 GRT (*Maicoa*) (appendix A2). The longlines deployed range from 8-65 km with from 500-4,000 hooks. Trips are lengthy (2-4 months) as the fish is frozen aboard and stored in refrigerated holds. The fishermen use bait shipped from Spain which they generally pick up in the nearby Chilean port of Arica because it is the busiest port in the area with the most frequent traffic of Spanish cargo vessels.[230] Some activity in 1997 has also been reported at Iquique.[231] A variety of bait is used, including sardine, mackerel, and squid. Presumably, local Peruvian species could be used for bait, but the fishermen are unfamiliar with the local species and do not want to risk experimenting--given the potential cost of unsuccessful trials. The catch is largely swordfish and sharks. The authors do not have detailed catch data, but the *Maicoa I* in July 1996 transshipped 180 t and 115 t (over 60 percent) of the retained catch was swordfish.[232] (The percentage would be much lower if the weight of the discarded shark carcasses was calculated.) The remainder was 45 t of shark ("marrajo"), 15 t of "quella" (English equivalent unknown), and 5 t of shark fins.[233] The crew consists of both Spanish and foreign fishermen, mostly Peruvian. The crew on the *Maicoa I* is 15

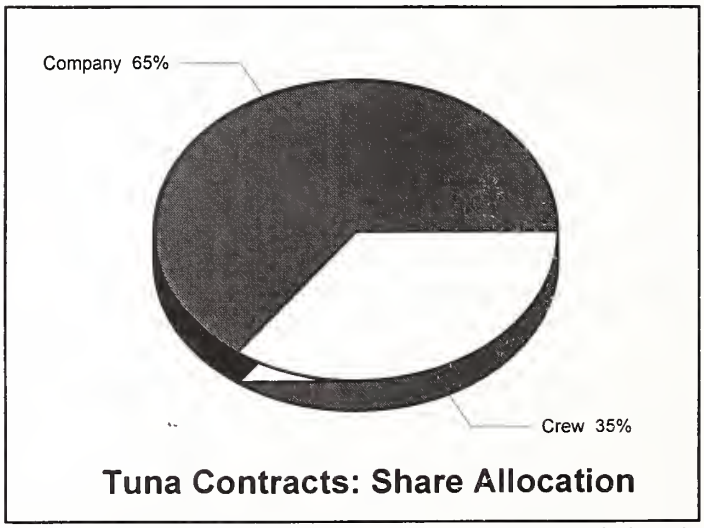


***Figure 15**.--The company keeps almost two-thirds of the proceeds from the catch and the crew gets about one-third.*

persons. The Peruvian crews are contracted through TRAMARSA. (See: "Companies.") The catch is mostly landed in Ilo, although Pisco and Callao are sometimes used, depending on the schedule of Spanish cargo vessels because most of the catch is shipped to Spain.[234] Increased activity in 1997 has been reported at Callao.[235]

Fishermen working on the foreign vessels are well paid by Peruvian standards. The crew receives a portion of the catch, depending on their position (appendix F and figure 15). The resulting earnings are well above average Peruvian wages, although there are some disadvantages for the workers. Trip lengths are much longer than Peruvians are accustomed to in their largely coastal domestic fishery. Living conditions in many cases are not ideal. In addition, on the Asian longliners, cultural difference are often a problem.

VII. Catch

Peruvian fishermen have for centuries taken swordfish. Although historical accounts describing the swordfish fishery do not exist, fishermen since ancient times are known to have taken occasional swordfish. Archeological reports describe finding swordfish bones in pre-Colombian communities. Fishing in the colonial period was minimal. The first modern reports known to the authors are accounts in the 1930s and 1940s describing fishing by foreign sport fishermen which helped stimulate the artisanal fishery. There was no significant commercial development, however, until after Word War II. Peru had no fish-freezing plants and thus the fishery was limited to supplying the domestic market where prices were very low. The fishermen thus had little incentive to target swordfish which required labor-intensive, often dangerous, fishing methods and specialized gear. A significant fishery developed during the late 1940s when the growing international demand combined with the availability of freezer facilities made it possible for Peruvian fishermen for the first time to initiate much larger scale operations supplying lucrative export markets).[236] The artisanal fishery in the late 1940s and early 50s landed significant quantities of swordfish. Export data suggest that landings reached about 3,300 t, but some catch estimates approach 7,000 t (appendix B2a and figure 16). Such quantities are larger than those currently being landed by any Latin American country. By the 1960s, the fishery had declined to minor levels and exports ceased, although a few good years were reported during the early 1970s. The reasons for the decline are not clear, but probably are related to the developing fishmeal industry. By the early 1990s, the harpoon fishery has disappeared. Most of the current swordfish catch is the incidental landings from semi-commercial artisanal longline fishermen primarily targeting sharks, and dorado--although a small number of other artisanal fishermen may still land an occasional swordfish. Some sizeable quantities are occasionally reported, but the source appears to be mostly foreign vessels. Some slightly higher catches were reported in 1992-93 as various Peruvian companies have initiated longline fisheries to enter the lucrative export market for high-quality fresh fish. Swordfish is one of the species they target, but their operations have varied widely from year to year. The 1994 domestic swordfish catch appears to have been only about 7 t from domestic operations (appendix B2a).[237] Thus despite efforts to develop the commercial longline fishery, there has been no significant increase in the catch. Efforts to deploy large commercial freezer vessels in pelagic fisheries, including two particularly important efforts (Tuna Latin and Consorcio Pesquero), have failed.[238] Few details are available on a third company (Pesquera Atlantis) currently operating commercial longliners. Several Peruvian groups believe that Peru might fare better using smaller longliners geared to supplying fresh fish, including tunas, swordfish, and other oceanic pelagics. Companies to date have achieved little success with such efforts.[239] Efforts continue and companies in 1996-97 have deployed a few Peruvian-built longliners designed to deliver high-quality fresh fish. At least one project (Sindicato Pesquero) is targeting swordfish.

Annual developments in Peru's swordfish fishery are as follows:

1930s: Peruvian fisheries as late as the 1930s was a marginal economic sector consisting of the limited operations of artisanal fishermen who supplied local markets with fresh fish. Overall fishing catches were negligible. The artisanal fishermen would occasionally land a swordfish or other billfish. Foreign residents working in mining and other sectors noticed these landings. Some were recreational anglers and reported the availability of big game fish off Peru and Chile, attracting the attention of other

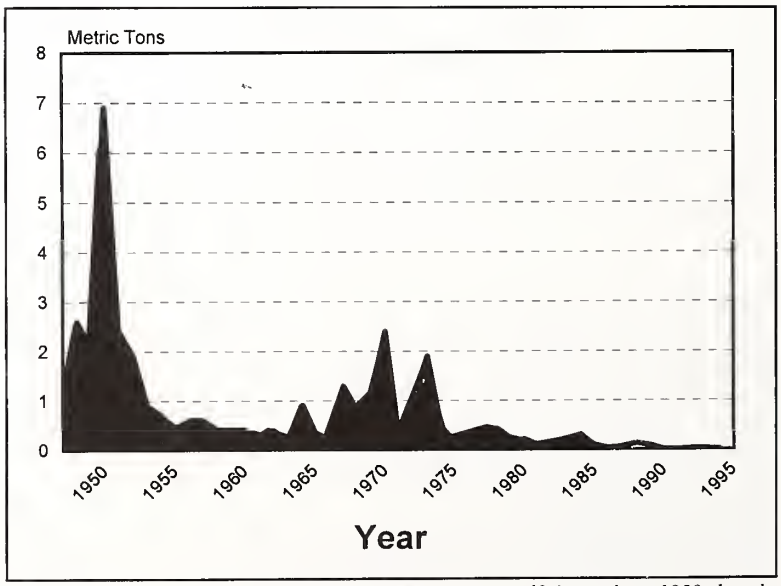


Figure 16.--Peruvian fishermen reported a massive swordfish catch in 1950, but the catch has since declined to minimal levels.

anglers in the United States. The interest of the foreign anglers in turn began to draw the attention of the artisanal fishermen. The foreign recreational activity reportedly "opened the eyes" of the local artisanal fishermen to the possibility of targeting swordfish.[240] Even so, catches were limited during this period and fishermen sold the fish at relatively low prices in the domestic market.

1940-45: Unlike neighboring Chile which developed a swordfish fishery during the 1930s, a significant Peruvian fishery did not develop until the 1940s.[241] Virtually no catch data is available, but one estimate suggests that only about 60 t were caught in 1940 (appendix B2a). The involvement of foreign sport fishermen was interrupted by World War II, but artisanal fishermen gradually increased catches. Peruvians began exporting swordfish to the United States during the war years, although no statistics are available on this trade. One observer reported exports of swordfish to the United States throughout World War II (1941-45).[242] Shipments may have been canned product. The authors can not, however, confirm this. The artisanal fishermen continued their small fishery during the War. Swordfish appears to have been relatively abundant, the primary factor limiting the fishermen was their inability to access lucrative export markets. There were no air cargo carriers which could transport fresh fish at reasonable cost and no domestic freezing plants so that landings could be frozen for export to the distant foreign markets. The fishermen had to rely primarily on the domestic market, but prices there continued to be far below international levels. As long as the fishermen could not market their catch abroad, the economics of the fishery were not attractive. Harpoon fishing required considerable skill and labor-intensive, often dangerous, operations to produce relatively few fish. Despite these constraints, however, fishing for swordfish expanded during the war years. Prices for swordfish on the domestic market were low, but they were still higher than for most other species.[243] In addition, many fishermen reportedly liked the "manly" ("macho") challenge of landing such a powerful fish. After the war, U.S. anglers again looked to the waters off Peru and Chile, further stimulating the interest of the local artisanal fishermen.

1946-52: The character of the Peruvian fishery changed significantly after World War II as the capability of freezing their catch first became available. U.S. tuna companies began running freezer vessels to Peru to freeze tuna.[244] The first U.S. vessels began working off Peru during the mid-1940s. Some of the vessels which worked with Peruvian companies apparently began processing the catch of the artisanal fishermen. The Peruvian artisanal fishermen delivering the fish used a wide variety of small craft and continued fishing almost entirely with harpoons. Fish were delivered fresh to the U.S. tuna vessels which served as motherships for freezing the catch. The U.S. fishermen worked with seven Peruvian companies and by 1950 had deployed nearly 20 freezer vessels. The Peruvian companies purchased the swordfish from the artisanal swordfish at sea or in ports and the U.S. fishermen operating the freezer vessels worked under contract. The principal ports were reportedly in the north, such as Paita. The prices paid to the fishermen were well above those available on the domestic market, making the swordfish fishery an especially profitable enterprise for the first time. With the incentive of higher prices, Peruvian fishermen rapidly expanded their effort on swordfish. A substantial fleet of artisanal boats operated from Paita to Máncora.[245] Sizeable catches were reported in Peru beginning in 1947, although accounts differ substantially on the precise quantities involved. Catches reported to FAO totaled 1,100 t (1947) and 2,600 t (1948) (appendix B2a). Another source based on export data suggests a much more modest, but still significant 540 t swordfish catch in 1948, based on product weight shipments of 420 t (appendix B2a). The first freezer facilities were U.S. freezer vessels brought to Peru, but they were soon followed by onshore freezer plants built at Paita and Ilo during 1950. Peru during this period reported some of the world's largest swordfish catches. Substantial catches were, however, landed during only a few years. The Peruvian catch appears to have peaked in 1950. Accounts differ widely on the actual quantities. Peru exported 2,585 t in 1950 which would have necessitated a catch of about 3,300 t (appendix B2a). FAO reports a mammoth catch of 6,900 t, but the authors have no other evidence confirming such a large catch. These levels are some of the highest swordfish catches ever reported by a Latin American country (appendix B2a).[246]

1950s: The fishery declined significantly after 1950, falling to only 400 t by 1955. The catch then leveled off at 400-600 t for the rest of the decade (appendix B2a). It is unclear why the fishery peaked in 1950 and declined to such low levels, but a variety of factors seems to have been involved. One possibility is over fishing, but given the use of harpoons, an enormous effort would have been required. Asian longline fisheries began to develop in the 1950s, but would not have affected catches off Peru in the early 1950s. Climatic changes could have affected both stocks as well as distribution. The small boats used by the artisanal fishermen gave them little flexibility as to where they fished. The vessels were not capable of high-seas operations and without ice holds they were restricted to a very limited range, having to return to port within a very short period after taking

a fish. Thus minor shifts as to where the fish appear could have had a major impact on the fishery. Probably the key factor in the fishery's decline was economic development during the decade which appear to have adversely impacted the fishery. Peru began developing a major fishmeal industry during the 1950s and by the late 1950s was beginning to harvest very substantial quantities of anchovy (appendix B1). The jobs associated with this new fishery as well as in other economic sectors may have drawn fishermen from less lucrative and more arduous artisanal fishing. In addition, the increasing anchovy harvests may have affected populations of other species, like swordfish, which at least indirectly may fed on anchovy. Peruvian biologists are, however, skeptical that the declining swordfish catch was related to the increasing harvests of anchovy. They point our that anchovy is highly coastal. Swordfish off Peru, in contrast, appears to be associated with waters of equatorial and oceanic origin and prey on the fauna in these waters. Biologists at IMARPE believe that high swordfish catches are related to climatic events like El Niño when oceanic fauna approaches the close along with the intrusion of warm tropical water into the coastal areas usually dominated by the cold Humboldt Current.[247]

1960s-70s: The Peruvian fishmeal industry founded during the 1950s reached major proportions in the 1960s. Massive catches of anchovy were harvested and delivered to an expanding number of fishmeal plants (appendix B1). The changes described above associated with the fishmeal industry may have impacted the artisanal swordfish fishery. The impact may have been more economic than the result of changes in ecosystem because of the removal of large quantities of anchovy.[248] Peruvian fishermen during most of the 1960-70s reported catches of only 200-400 t, although a few relatively high swordfish catches were reported during the late 1960s and early 1970s. Fishermen reported, for example, a swordfish catch of 2,400 t in 1970 (appendix B2a). After 1973, however, the catch plummeted again to less than 200 t in 1979. Peruvian companies continued to export during the 1960s, but only a fraction of production (appendix C1). Significant exports ceased and most of the small Peruvian swordfish catch during the 1970s appears to have been marketed domestically (appendix C2). No export shipments were reported, for example, in the mid-1970s (appendix E2a1 and figure 24).

1980-82: Swordfish catches continued at low levels during the early 1980s, falling below 100 t in 1981 (appendix B2a). Most of the catch was marketed domestically. Only minor quantities of frozen product were exported (appendix E2a1).

1983-84: Fishermen reported improved landings in 1983 of about 230-240 t (appendix B2a).[249] Most of the 1983 catch was landed at Chimbote which is usually not an important port for the swordfish fishery (appendix B3c1). IMARPE reported that a substantial portion of the catch (73 t) was not taken by domestic fishermen, but rather landed as a by-catch of the Soviet factory trawler fleet (appendix B3c2 and B6).[250] No details are available on Soviet operations, but they are known to have extensively used mid-water trawls off Chile and Peru as well a few bottom trawls along the northern coast.[251] Peruvian fishermen reported a substantial increase in 1984 to 300-340 t, while FAO and IMARPE data differed slightly. IMARPE reports that much of the 1983 catch and almost all of the 1984 catch was the incidental catch of factory trawlers operating off northern Peru (appendix B3c2).[252] Virtually all of this catch appears to have been marketed domestically. No exports were reported in 1983 and only a minimal 1.6 t in 1984 (appendix E2a1).

1985-89: The status of the swordfish fishery during this period is very difficult to assess. FAO and IMARPE report very different results. FAO, for example, reported a catch of nearly 130 t in 1988 while IMARPE reported only about 55 t (appendix B2a).[253] It is unclear why the two vary as the Peruvian Government is the source of the data published by FAO. FAO reports that Peruvian fishermen continued catching swordfish in 1989, taking over 80 tons. However, IMARPE reports that by 1989 the catch had fallen to negligible levels. Changes in the number of factory trawlers and resulting by-catch appear to have been the primary cause of the catch fluctuations reported by IMARPE. The by-catch declined sharply in 1985 and was not reported at all during 1986-89 (appendix B3c2). Virtually all of this catch appears to have been marketed domestically. Only minimal exports were reported during 1985-89. The largest shipments were 11 t to the United States in 1989 and 1 t to Japan (appendix E2a1-E4a and figures 22 and 24). Although minor, the first fresh swordfish exports were reported in 1985 and all of the 1989 shipments were fresh product.

1990-91: Peruvian fishermen reported virtually no swordfish catches during 1990-91. Both FAO and IMARPE report catches of only 1-3 t (appendix B2a). Such minimal catches are generally confirmed by U.S. import data which show no shipments in 1990 and only 5 t in 1991 (appendix E2a2). The fact that the 1991 imports were fresh product confirms that it was landed by domestic Peruvian fishermen.

1992: Small catches increases were reported beginning in 1992. Even so, the 1992 catch was still a modest 16-21 t (appendix B2a). The European

Union reported substantial swordfish shipments from Peru in 1992 (appendix E3 and figure 21). The authors believe, however, that this may not be fish caught by Peruvian fishermen, but rather transshipments from Spanish fishermen operating in the Pacific. Spanish fishermen are known to have been active out of Peruvian ports during this period. (See: "Transshipments" and "International".)

1993: IMARPE and FAO report domestic catches of about 20 t in 1993. This is complicated somewhat by an additional 55 t of by-catch that IMARPE reports was taken by factory vessels (appendix B3d2). The authors have been unable to obtain details on the vessels involved. Unlike the by-catches reported in the 1980s, they do not appear to have been Russian vessels. The United States and Japan reported no imports, but the European Union imported 31 t (appendix E2 and figure 21).

1994: Accounts differ significantly as to the 1994 catch. FAO reports only 5 tons (appendix B2a). IMARPE, in contrast, reports catches totaling 310 t (appendix B3d2). The authors note that almost all of the 1994 catch was landed in Ilo. Only 7 t was reportedly taken on the traditional northern fishing grounds. The source of the remaining 303 t is unclear. The authors have been unable to explain the sizeable Ilo landings. Several possibilities exist. They could also be due to the acquisition by Consorcio Pesquero of a larger freezer longliner (the *Maria José*) in 1993 (appendix A2).[254] The Consorcio, however, generally used Callao for its vessels. The increased 1994 catches could possibly be due in part to the longline vessels which the Japanese reportedly donated to university groups, although observers report the results were disappointing. (See: "Research" and "Foreign Aid".) Another possibility is transshipped product taken by foreign fishermen or the catch of associated foreign vessels. Spanish fishermen operating outside the 200-mile limit were active out of Peruvian ports, especially Ilo during the early 1990s, but they reported disappointing catches during 1994 and withdrew from the fishery.[255] The virtual absence of exports during 1994, only about 8 t to Japan, suggests that actual domestic catches were probably limited to the 7 t reported by IMARPE on the traditional northern grounds (appendix E2).

1995: Swordfish catches in 1995 were minimal. FAO reports no catches and IMARPE reports only 7 t (appendix B3d2). Consorcio Pesquero acquired another large freezer longliner in 1995, but as it was registered in Panama, the catch would not be included statistically in the Peruvian catch. Consorcio Pesquero, at the time the major Peruvian company conducting pelagic longline operations, reported a 1995 swordfish catch of about 50 t, but much of this was taken with its Panamanian-flagged vessel (appendix A2).[256] (See: "Companies".) Spanish fishermen suspended Pacific operations in 1995.[257] Trade data suggests a slightly higher catch than reported by IMARPE. Exports totaled about 29 t, mostly to the European Union (appendix E2).

1996: No data is available on Peruvian 1996 swordfish catches, but they were probably similar to 1995. Such catches continued to be incidental to the Peruvian effort directed specifically at tuna, sharks, and other species. The major Peruvian company operating longliners, Consorcio Pesquero, reported disappointing results.[258] Peruvian exports of oceanic pelagics to the United States in 1996 increased somewhat, but were still less than 1 t (appendix E2a1). A few Spanish fishermen returned to the southeastern Pacific and reported good swordfish catches outside the 200-mile limit off southern Peru and northern Chile.[259]

1997: No 1997 catch data is available, but fishermen should report a substantial catch increase. Consorcio Pesquero, one of the principal Peruvian companies conducting commercial longline operations, ceased longline operations in 1996. The company had reported disappointing longline catches.[260] Other companies are, however, reporting catches. Pesquera Atlantis is reportedly operating its longliners, but no details are available. Some significant swordfish catches may be reported toward the end of the year. Another company, Sindicato Pesquero, has deployed three small longliners which it has deployed for swordfish.[261] The company has reported some success in trials off southern Peru (appendix B8a1). In addition, artisanal fishermen in 1997 reported that they were taking unusually large numbers of billfish in addition to some swordfish in their coastal shark longlines. Local observers believe that warming ETP water temperatures are the primary reason. Sindicato Pesquero rushed the deployment of its new longliners to take advantage of the favorable oceanographic conditions.[262]

Photo 30.--Artisanal fishermen in many areas have to land their catch directly on the beach with no sanitary or support facilities. Robert Webster

VIII. Ports

Peruvian observers report that the lack of adequate port facilities is a major impediment to the development of a modern fishing industry. Many artisanal fishermen continue to operate with virtually no port infrastructure (photo 30). Much of the country's commercial port infrastructure used by the fishing industry were built in the late 1950s and 60s by fishmeal companies and are now inadequate and deteriorating.[263] Peru as part of its overall process of privatizing state corporations is preparing to sell the state companies currently operating Peruvian ports.[264] Trade associations representing companies working at the ports are concerned about the current process. The companies involved, for the most part, accept the Administration's privatization policy, including port services. Many are concerned, however, with the privatization of the piers and adjacent areas. They have expressed reservations about both future operations and the financing of needed port infrastructure expansion.[265]

The Peruvian swordfish fishery during the early 1950s was primarily conducted out of Máncora, Paita, and other small northern ports, especially Cabo Blanco (figures 5 and 6). Some fishing occurred from the southern ports of Mollendo and Ilo, but were of lesser importance. Currently the major ports involved in the domestic longline fishery are Callao, Ilo, and Paita (figure 17).

Cabo Blanco: This is a small artisanal port near Talara. It was an important center of the artisanal harpoon fishery for swordfish during the 1940s and early 1950s. Much of the recreational fishing reported by foreign fishermen during this period was conducted from Cabo Blanco. The important fisheries are now for small pelagics, including jack and horse mackerel and sardine. There are still no modern processing facilities and the catch has to be sold when landed, often at low prices.[266] FONDEPESCA in 1992 was reportedly financing the construction of an artisanal port.[267]

Callao: Callao is Peru's major port located only a few kilometers from Lima. It has port facilities capable of handling the largest fishing vessels. The Consorcio Pesquero freezer longliners (*María José* and *Paloma*) landed their catch at Callao. The licensed Japanese longliners targeting tuna in association with Peruvian companies land most of their catch in Callao, both the tuna and incidental catch of swordfish and other species. The Japanese vessels fishing on the highseas call at Callao to purchase fuel and supplies, but do not land their catch at the port. Most of these vessels reportedly transship to refrigerated cargo vessels on the highseas.[268] Two companies (Servinave and Japan Tuna del Peru), created to assist the Japanese fleet operating in the eastern Pacific, are based in Callao. These companies help purchase supplies, take care of the many problems faced by fishermen operating away from home, and help recruit Peruvian crew members. The revenue generated by the foreign vessels is significant. One report suggested that in 1989 the Japanese vessels (the principal country involved) generated about $100 million in business at Callao, involving refueling, repairs, supplies, and local crew contracts.[269] While the Spanish longline fishermen mostly use Ilo, they also occasionally call at Callao, depending primarily on the schedule of Spanish cargo vessels. The Spanish longliner *Maicoa I*, for example, landed its catch at Callao during July 1996.[270] There has also been expanded Spanish activity at Callao during 1997.[271] Peru's largest shipyards are located at Callao. While they focus primarily on anchovy

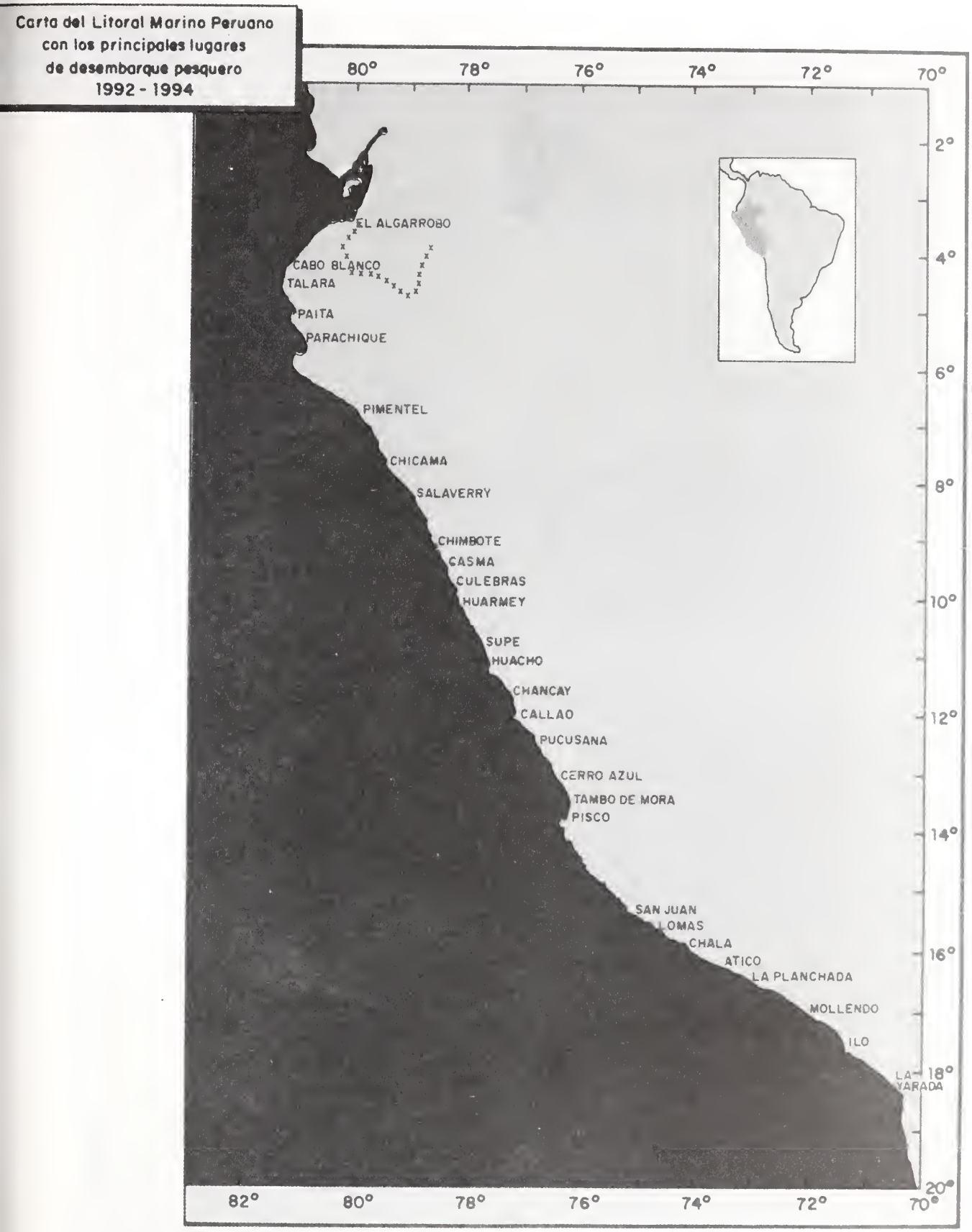


Figure 17.--Principal Peruvian fishing ports, 1992-94. IMARPE

Photo 31.--Foreign fishermen, especially the Spanish, have extensively used the port of Ilo for their southeastern Pacific longline operations. José Echeandía Zegarra

seiners, one small yard in 1997 built three small longliners. (See "Shipyards".)

Ilo: The copper mining industry has extensive refining and shipping facilities at Ilo (photo 31). Fisheries is another major local industry. Peruvian domestic fishermen have landed very little swordfish at Ilo (appendix B3 series). Spanish longliners reportedly transship their swordfish catch primarily through the commercial port at Ilo. Facilities for artisanal fishermen were built in 1988, including a pier located close to the PESCA-PERU plant.[272] Cold stores operated by the wholesalers are available. Transshipments by foreign longliners were reported during 1993.[273] Shipments declined sharply in 1994, there were none in 1995, but Spanish activity increased in 1996. (See: "Transshipments.") The authors know of several Spanish vessels that have been active during 1996-97 (appendix A2). The Spanish also use the port to purchase supplies and fuel, and to contract local crew members.[274] The shipping company TRAMARSA handles their affairs in Ilo. (See: "Companies.") An Ilo shipyard in 1996 built the first Peruvian longliner, a 25-GRT vessel.[275] (See: "Shipyards.")

Máncora: This is one of the northern ports (4°S) that was especially important during the 1940s-50s when the harpoon fishery was active. One U.S. observer in the 1950s referred to it as the "Gloucester of Peru."[276] A report prepared in the mid-1980s indicated that there was no pier for the artisanal fishermen who had to beach their small boats or employ reefers to bring the catch ashore.[277]

Paita: Paita was the center of Peru's whaling industry, conducted through a Japanese joint venture during the 1950s-60s. Much of Peru's effort to initiate a modern tuna industry has centered on Paita.[278] Paita is now Peru's major northern fishing port (photo 32). The Soviets helped construct a modern fisheries complex at Paita during the 1970s (photo 33).[279] Some of the most modern port facilities constructed for PEPESCA are being used by the Navy and thus unavailable to the local fishermen.[280] Some swordfish is reportedly landed fresh in Paita by small longliners targeting shark. These vessels are operated by Agro-Pesca and other companies.[281] Other companies such as Consorcio Pesquero/ Productos Pesquero Peruano and Sindicato Pesquero are also active at Paita.[282] This activity at Paita appears to be a relatively recent development, as

Photo 32.--A large number of artisanal and commercial vessels operate from Paita, including many of the longliners that target shark. Dennis Weidner

Photo 33.--Substantial quantities of swordfish were landed at several northern ports during the 1950s. A modern fisheries complex has been built at one of these ports -- Paita. Dennis Weidner

IMARPE has reported relatively limited swordfish landings at Paita (appendix B3.)

Artisanal fishermen often use Puerto Nuevo at Paita, but facilities there are very limited.[283]

Pisco: Peruvian fishermen reportedly land very small quantities of swordfish in the south, mostly in Pisco. Spanish fishermen occasionally transship through Pisco, depending on the shipping schedules of Spanish cargo companies.

Talara: This is another of extreme northern ports where the harpoon fishery was conducted during the 1940s-50s.

Others: Peruvian artisanal fishermen land small quantities of swordfish at several smaller ports. In recent years there has been some swordfish landed at Punta Cancas and Zorritos. Over the past few years activity has been reported at more than 15 ports, although the quantities of swordfish landed vary significantly from year to year (appendix B3 series). One such port was Caleta Cruz. The Government built a modern fisheries pier there, but the floods associated with the 1982 El Niño silted in the area and the pier is now 20-30 m from the water (photo 34). Another port increasing in importance is Manzarani-Arequipa. Fishermen there

Photo 34. -- A substantial pier was built at Caleta Cruz in northern Peru, but it was silted in by the 1982 El Niño. Dennis Weidner

Photo 35.--Artisanal and commercial vessels at Manzarani-Arequipa where substantial quantities of shark are being landed. Eduardo Pastor

report limited swordfish catches, but they have been landing substantial quantities of shark which is mostly marketed in Lima (photo 35).

Photo 36.--The Vigo-based Spanish longliner Maicoa Uno operated out of Ilo during 1996. José Echeandía Zegarra

IX. Transshipments

Peruvian officials confirm that foreign longliners transship swordfish through Peruvian ports, primarily Ilo. Peruvian regulations require that the fishermen obtain permits for each transshipment through a Peruvian port.[284] The principal fishermen involved appear to be Spanish longline fishermen based in Vigo (photos 36-46). The Japanese have transshipped through Peruvian ports in the past, but now mostly transship at sea. A few Japanese fishermen obtain Peruvian licenses and work in association with Peruvian companies. These licensed vessels land their catch in Peruvian ports. While not technically a transshipment, in reality these shipments are for all intents and purposes very similar to transshipments as the Japanese also participate in the marketing of the fish.

Japan: The Japanese reportedly used to primarily transship through Callao, but some activity also took place at Ilo.[285] Much of the product transshipped in the past by the Japanese was tuna. The quantity transshipped by the Japanese has declined in recent years. Most of the substantial Japanese tuna, billfish, and swordfish catch in the ETP is transshipped at sea. The Japanese still call at Callao, but mostly to obtain supplies, make minor repairs, exchange crews, and conduct other business. The Peruvians have tried to interest the Japanese in using available cold stores, but the Japanese have declined to do so--in part because the Peruvian cold stores are not capable of reaching -50°C.[286] The Japanese motherships, however, came into Callao during the 1990s to take on tuna landed as part of association agreements with Peruvian companies. The Japanese longliners operating with Consorcio Pesquero during 1996, for example, transhipped their catch.[287] The Japanese had a close relationship with Consorcio Pesquero, but the company ceased operations in 1997 and its assets were absorbed by the parent company, Productos Pesqueros Peruanos. (See: "Companies.")

Spain: The Spanish are the only foreign fishermen in the ETP directly targeting swordfish. The first Spanish transshipments through Peruvian ports were

Photo 37.--Frozen swordfish in the hold of the Maicoa Uno. José Echeandía Zegarra

***Photo 38**.--Unloading swordfish trunks at Ilo. Note the extremely large size of the these fish which are much larger than generally reported in Atlantic fisheries. J. Echeandía Z.*

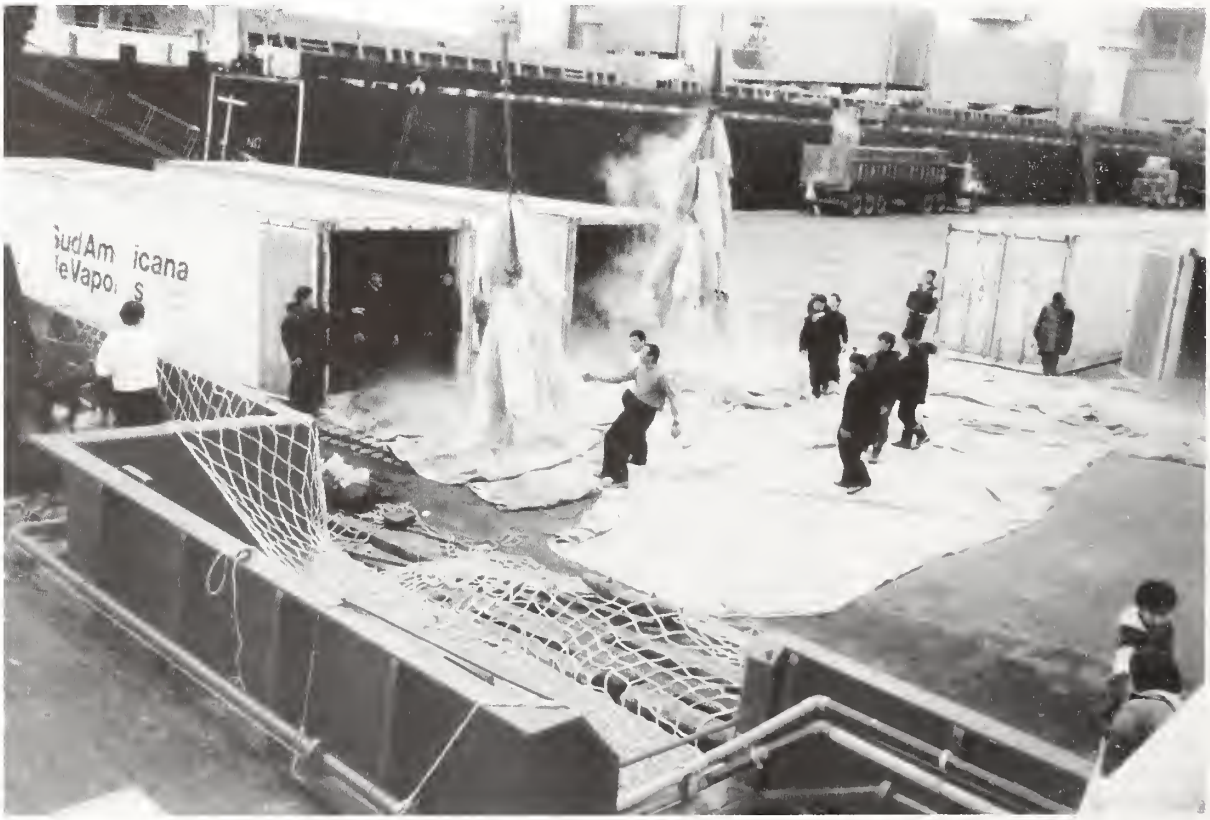


***Photo 39**.--The Spanish conduct a directed swordfish fishery and the species constitutes a very high proportion of the catch. Note the small size of the fish in the background. J. Echeandía Z.*

***Photo 40**.--Landing trunks of mixed size. Some vessels are equipped with deck cranes. The fishermen at Ilo can also use the portable cranes which can handle substantial loads. J. Echeandía Z.*

***Photo 41**.--Stacking the frozen swordfish trunks in the refrigerated containers to be loaded aboard a Spanish cargo vessel. Note the mixed sizes of the trunks. José Echeandía Zegarra*

Photo 42 --Tarps are spread on the pier to prevent damage to the trunks from the rough concrete. José Echeandía Zegarra

reported in the north Atlantic declined and the Spanish shifted to the south Atlantic and other grounds such as the eastern Pacific.[288] Spanish fishermen operate in much smaller numbers than the Japanese and do not have the support system, such as dedicated refrigerated fish carriers, available to the Japanese. Given the distance from Vigo, the Spanish need a local ETP port to transship their catch. The Spanish have primarily worked out of Ilo (photos 36-46). One report suggests that the Spanish are transshipping large quantities of juvenile swordfish and transshipping them through Ilo.[289] The Spanish appear to be fishing largely off central and northern Chile and southern Peru.[290] They appear to fish as far as 800 km off shore.[291] One of the areas targeted by the Spanish is reportedly the Nazca Ridge. Chilean sources report that there is a high concentration of juvenile swordfish on the Nazca Ridge.[292] An official of the Peruvian company handling the shipments, however, denies the Spanish are transshipping small swordfish. He reports that most of the swordfish is 80-320 kg fish, but some is as small as 20 kilograms.[293] The authors have no independent data to be able to assess these conflicting reports.

The principal port involved with swordfish transshipments is Ilo, although there are transshipments through other ports as well. Foreign fishermen operating in the southeast Pacific have few alternatives to Peruvian ports for transshipping their catch. They would have preferred to use Chilean ports. Chile does not, however, allow foreign fishermen to transship swordfish through their ports, although a variety of other species which Chilean fishermen do not target can be transshipped.[294] Ecuador and Colombia do not permit transshipments.[295]

Ilo: Spanish fishermen targeting swordfish in the eastern Pacific have used the southern port of Ilo (photos 37-46). (See: "Ports.") The Spanish have generally choose Ilo because it is the closest open port to their major swordfish grounds off Chile.[296]

Activity: There was substantial activity at Ilo through 1994, but no transshipments were reported in 1995. One report suggests that disappointing catches during 1995 and the subsequent withdrawal of Spanish vessels from the Pacific explain why transshipments have declined.[297] Some activity has resumed in 1996-97. Five Spanish vessels (*Alicante*, *Arosa Primera*, *Maicoa, Maicoa I*, and *Urugora*) are known to have transshipped during 1996. At least two Spanish vessels (*Maicoa* and *Rosu III*) are known to

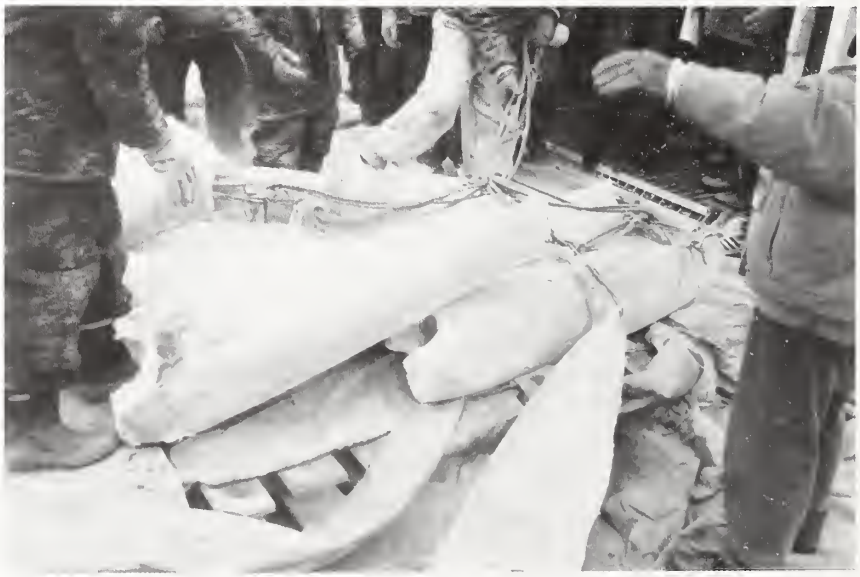


Photo 43 --Swordfish trunks to be loaded in refrigerated containers. Note the small size of some fish which are comparable to the sizes harvested in U.S. fisheries. José Echeandía Zegarra

***Photo 44**--Containers being loaded aboard Spanish refrigerated cargo vessels for shipment to Spain. José Echeandía Zegarra*

***Photo 45**--Transshipments at Ilo often continue into the night when unloading a large longliner like the Maicoa Uno. José Echendía Zegarra*

Photo 46.--Loaded containers being closed during a nighttime transhipment at Ilo. Note that the container is completely filled. José Echeandía Zegarra

have transshipped in 1997. Other Spanish longliners were active in the southeastern Pacific and may have also transhipped through Ilo (appendix A2 and Chile, appendix D4).

Shipments: There is little data available on transshipments. One of the Spanish vessels, *the Maicoa*, in June 1996 reportedly transhipped swordfish (85 t), shark (60 t), and shark fin (5 tons). This may be an unusually large quantity as the *Maicoa* is larger than most Spanish longliners. The *Rosu III* which transshipped its swordfish catch a Callao in June 1997 also landed substantial quantities of shark (blue and makos) and seabass ("vidrio").

Transport: The transshipped product was loaded aboard refrigerated containers and shipped to Valencia in a Spanish cargo vessel, the *Tamamonta.*[298]

Callao: The Japanese reportedly used to transship through Callao, Peru's principal port. They have in recent years curtailed such shipments. The catch of Japan's highseas longline fleet is now reportedly transshipped mostly at sea.[299] The Japanese motherships do call at Callao and take on tuna and swordfish caught and processed by Peruvian companies.[300] The Japanese longliners working in association with Peruvian companies do transship at Callao. There are also reportedly occasional Spanish transshipments as well, depending on the sailing schedule of Spanish merchant vessels.[301]

Pisco: There are reportedly occasional Spanish transshipments, depending on the sailing schedule of Spanish merchant vessels.[302]

The Ministerio de Pesquería (MIPE) supervises the transshipping process and collects data on landings. MIPE inspection officials board each vessel and review the log books. One official reports that transshipping activity in 1994 and 1995 was limited, but a few Spanish vessels transshipped during 1996.[303] The Japanese and Spanish catches are then loaded aboard cargo vessels of each country.[304] Peruvian officials do not, however, collect data on the disposition of the transshipped product. It is likely that much of the swordfish imported by the European Union (appendix E3) may be swordfish transshipped by Spanish fishermen. The small 1992 Peruvian swordfish catch, for example, was only a fraction of the 155 t the EU reports receiving from Peru (appendices B2a and B3d2).

Peru poses some disadvantages to foreign fishermen desiring to transship their catch.

Quality: The reports of quality control problems and outbreaks of cholera are of special concern to fishermen handling high-value species where the quality is critical. Sensational press reports in the 1990s have attracted world attention. These reports have adversely affected the prices for Peruvian exports and product transshipped through Peruvian ports by impairing the image of Peruvian seafood. Some observers indicate that the cholera and other health problems have discouraged foreign fishermen from transshipping through Peruvian ports. Other sources insist, however, that the cholera problem in Peru has been exaggerated by sensational press reporting. There was a serious country-wide outbreak in the early 1990s, but Government measures to control the disease have reportedly succeeded.[305] There have been no major reports of recent outbreaks. While the extent of the health problem is unclear, some foreign fishermen may still be concerned about shipping through Peru. The need for Peruvian and other foreign companies to initiate Hazard Analysis Critical Control Point (HACCP) systems to export to the United States may help assure potential importers of the quality standards of Peruvian exporters.

Distant grounds: Chilean ports are closer to the primary Spanish fishing grounds thus they would have been the preferable swordfish transshipment points. The use of peruvian ports requires much longer trips from the fishing grounds.

X. Processing and Products

The authors have few details on swordfish processing in Peru. Historical accounts suggests that the swordfish landed during the early and mid 1940s was primarily marketed fresh in local markets. (See "Catch".) Small quantities may have been canned for export. As the fishery developed and freezing facilities became available, most of the catch in the late 1940s and 1950s was primarily frozen for export. MIPE data available beginning in 1985 indicates that most of the catch during the 1960s was frozen, although substantial quantities were marketed fresh in 1968 (appendix B2b and figure 18). Large quantities were frozen in 1970 and 1973. The primary product form, however, shifted to fresh during most of the 1970s. The quantities of swordfish processed, however, declined sharply. Little data is available for the 1980s and 90s as such small quantities of swordfish were caught.

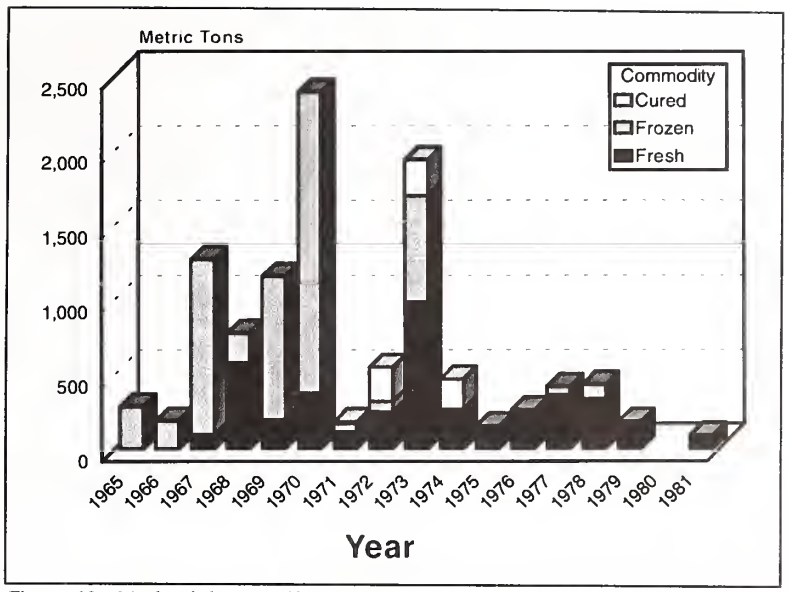


Figure 18.--Much of the swordfish catch in the 1960s was frozen, but beginning in 1971, processing shifted to fresh product.

***Photo 47.**--Much of Peru's high quality edible fish is taken by trawlers. Note incidental capture of a seal. Robert Webster*

***Photo 48**--Processing hake taken off northern Peru. Almost no swordfish has been processed in recent years. Dennis Weidner*

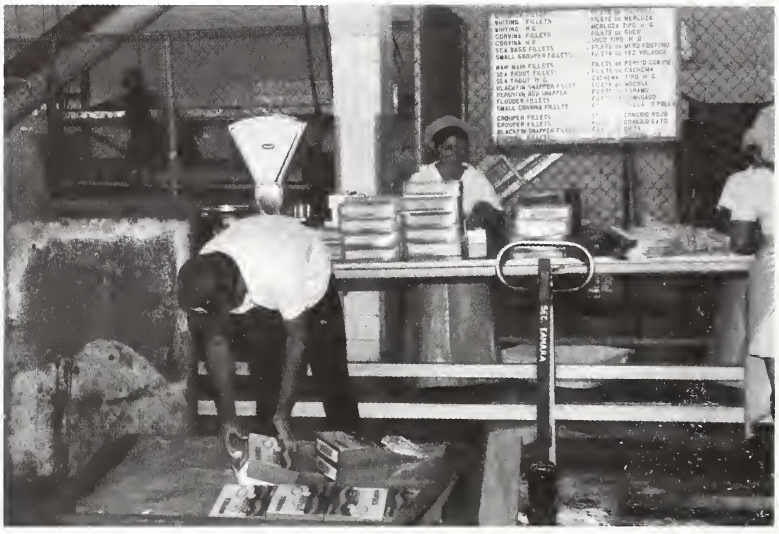


***Photo 49**--Peruvian companies in northern Peru supply frozen hake and other demersal finfish. Dennis Weidner*

***Photo 50**-- During El Niño events companies, which normally process demersal finfish, pack large quantities of tropical shrimp taken in the unusually warm waters. Dennis Weidner*

There is currently only limited processing of oceanic pelagics in Peru. Peruvian companies have, however, given greater attention to producing edible fish and the handling and processing standards have improved in recent years (photo 47). Much of Peru's processing of edible finfish takes place in northern ports such as Paita, but the companies there primarily focus on demersal species (photos 48-50). A few companies have unsuccessfully attempted to supply high-quality frozen tuna (Tuna Latin and Consorcio Pesquero), but their efforts to operate commercial longliners failed. (See "Companies.") There is also some limited processing of shark and dorado (Agro-Pesca, Abastecimientos, Grupo Sotomayor, Industrias Pesqueras Daruma, Luming, and other companies). The shark and ray catch was initially marketed fresh without further processing, but companies now process fillets.[306] The Peruvian consumer appears to be more familiar, or willing to buy, dogfish ("tollo") than shark ("tiburon"). Thus shark fillets are often marketed as dogfish.[307] The ITP did some work assessing the drying of shark to market as a substitute for imported cured cod.[308] Other companies (R. Muelle) offer various other shark products such as cartilage and leather. As the shark catch has declined in recent years so has the output of shark products (appendices B5b and C3 and figures 19 and 26).

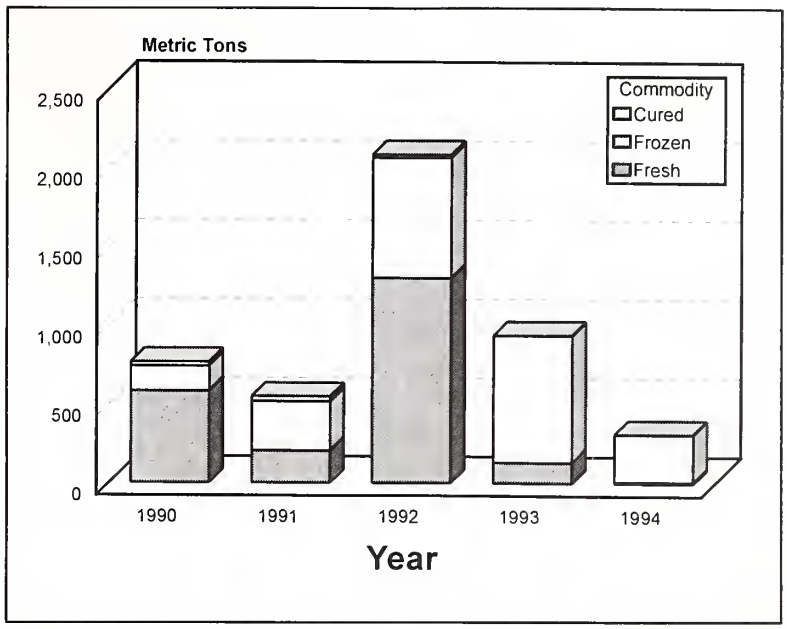


Figure 19 *--Peru's output of shark products has declined sharply since 1992, especially frozen product.*

Swordfish availability is very limited. The small amounts of swordfish caught by domestic fishermen is landed fresh. Fish of adequate quality is then exported without further processing to the United States (appendix E2a1). The European Union and Japan import frozen product, but it is not clear that the product involved was actually caught by domestic fishermen. The authors know of no Peruvian company processing swordfish.[309] This could change in 1997, depending on the success of Sindicato Pesquero's new swordfish project. The authors have no Peruvian processing data, but foreign import data suggests that overall production declined sharply in 1993 and 1994 (appendix E2). Peruvian companies handle only small quantities of both fresh and frozen product.

Frozen: Most of the Peruvian swordfish production in 1995-96 was handled by Consorcio Pesquero as part of the by-catch of its tuna longline operations. The Consorcio's catch was headed and gutted at sea and stored in freezer holds. It is then exported as whole frozen fish without further processing.[310] The Consorcio wanted to produce sashimi-grade fish for export to Japan, but achieved disappointing catches. The company ceased its unprofitable longline operations in 1996-97 and has sold its longliners. (See: "Companies.") One was sold to a foreign company and another to a Peruvian company, Cazamar.[311] The authors know of no companies currently freezing domestically produced fish.

Fresh: Artisanal fishermen still land small quantities of fresh swordfish. Sindicato Pesquero, one of Peru's most important companies, is building three small longliners in 1997 and plans to target swordfish for export as fresh product.[312] A least one other company (Pesquera Eraz) is shifting from demersal to pelagic longlining).[313]

Cured: Small quantities are also reportedly cured.

XI. Companies

A. Trade associations

The principal fishing industry trade association is the Sociedad Nacional de Pesqueria (SNP) which has a membership of more than 100 companies. The Sociedad was formed in 1952 to promote the interests of the country's entire fishery industry, including fishing, processing, and exporting companies. The SNP has been primarily concerned with the country's massive fishmeal industry. The ongoing privatization process and Government fisheries management policies have in recent years been the SNP's primary concern.[314] (See: "Government Policy: Fisheries management.") The SNP is currently reviewing a new bill on fisheries management released for comments in February 1997. Other concerns include the modernization of the fleet, the large canning industry, and quality control standards. Involvement with the still fledgling longline industry have been limited. The primary Peruvian fishing fleet is composed of still relatively small purse seiners targeting anchovy. Two other important industry trade associations promote the interests of vessel owners, the Sociedad Nacional de Armadores Pesqueros and the Sociedad de Nuevas Embarcaciones Pesqueras (appendix D).

B. Companies

Several companies in the 1970s and 1980s attempted to initiate tuna purse-seine fisheries, but were unsuccessful. This may in part have been due to the popular suspicions and mistrust of foreign investors and fishermen. Government and private efforts to attract foreign investment and technology during the 1970s and 80s, especially in the fishing industry, proved highly controversial. Frequent policy changes and revisions in the regulatory regime adversely affected several joint ventures.[315] In some cases these changes invalidated commercial contracts after foreign and domestic investors had made equity commitments. This created a very uncertain, often onerous environment for foreign investors.[316] Given the limited Peruvian experience with tuna and the sophisticated modern technology required, foreign partners could have played a valuable role. Several Peruvian state and private companies attempted tuna fisheries without foreign partners. Other companies attempted to attract foreign partners, but potential partners were often discouraged by the complicated and changing regulatory regime which in some cases established burdensome conditions and extremely high fees. Most of the other Latin American countries which have successfully initiated fisheries for oceanic pelagics (mostly tunas) have had a variety of programs which attracted foreign investors and fishermen through various formal or informal joint venture or leasing arrangements. In other cases, provisions were made to contract experienced foreign captains and fishing technicians.

Peruvian fishing operations on oceanic pelagics are currently limited. Several attempted tuna ventures have failed. Little effort has been made to target swordfish since the artisanal harpoon fishery declined during the 1950s. The ambitious Consorcio Pesquero effort in 1995-96 to initiate a longline operation for sashimi-grade tuna and swordfish failed. Sindicato Pesquero is planning directed swordfish operations in 1997 with three small longliners. A few Peruvian companies, such as Agro-Pesca, conduct longline fisheries for other species such as shark and dorado. The shark fishery, however, has declined sharply in recent years (figure 26). (See "By-catch.") Available details on these and other companies associated with tuna, swordfish, and longline fisheries are as follows:

Abastecimientos Marinos: This company among other commodities handles shark fins.

Agro-Pesca: Agro-Pesca is primarily involved in the hake trawl fishery and operates eight trawlers. Its processing facilities and pier are located at Tierra Colorada, just south of Paita.[317] The company also contracts with artisanal fishermen operating small longliners (under 10 m) to supply dorado and shark (makos and blues). The operations are highly seasonal: dorado (January-February), mako shark (March-August), and blue sharks (April). Agro-Pesca only signs such contracts when U.S. prices are high enough to sustain profitable operations. When prices are favorable, the company has contracted as many as 30-40 artisanal boats at one time. Agro-Pesca processed 500 t of dorado in 1995. Most of the production was exported fresh to the United States, but small quantities were also shipped to Caribbean countries. The company did not renew the contracts in 1996 because of low market prices. The company does not currently handle either tuna or swordfish.[318] Agro-Pesca reportedly studied possible tuna/swordfish longline operations and decided against them for now. Strict Government regulations limiting by-catch to 10 percent and the cost of the additional licenses discouraged company planners.[319]

Atunera Bolivariana: This company was established in 1988. It purchased the four partially completed 1,000 ton PEPESCA tuna seiners as part of an effort to initiate a tuna fishery.[320] The company never succeeded in completing construction of the vessels and they were eventually placed in the hands of receivers.

Cazamar: This company purchased the longliner *María Jose* from Consorcio Pesquero in 1997. Unconfirmed reports indicate that the vessel has been shifted to demersal operations.

Consorcio Pesquero: Consorcio Pesquero was established in 1993. It is an affiliate of a large holding company, Productos Pesqueros Peruanos (PPP) and the Grupo Sotomayor. It was one of the principal Peruvian companies producing edible product. The company was involved in fishing, processing, and exporting seafood. It began operations in 1993 by forming a joint venture with a Japanese company. They deployed one freezer longliner (*Maria José)* which was 25-m long (59 tons storage capacity) and registered under the Peruvian flag. It was operated with a foreign crew, primarily Japanese. The company obtained a Peruvian fishing license which allowed fishing within the 200-mile zone, but closed a 48-km (30-mile) coastal zone to protect artisanal fisheries.[321] Consorcio Pesquero in 1995 acquired another freezer longliner *Paloma*, which has a 90 t hold, but registered under the Panamanian flag. Consorcio Pesquero has licenses for shark, swordfish, and tuna operations. Both longliners targeted tuna (yellowfin and bigeye). They deploy 80-km longlines with 2,000 hooks. The two Consorcio longliners generally operated from 300-1,600 km off the coast.[322] Fishing trips lasted as long as 4-6 months. The *Maria José* was operated inside Peruvian waters, whereas the Panamanian-flagged *Paloma* is operating outside the 200-mile Peruvian EEZ. The target species were tunas (bigeye and yellowfin), but swordfish and sharks (mako, tiger, porbeagle, and blues, among others) were also caught. The two Consorcio longliners reported average retained catches of tuna (200 t), swordfish (50 t) and sharks (50 t) per year. All of the catch was processed at sea (headed and gutted, H&G) before being frozen. The tuna and swordfish catch was transshipped to Japanese freezer boats in Callao for export to Japan. The shark, except the fins, was marketed domestically in Peru.[323] Consorcio Pesquero in 1995 secured $6.2 million in financing from the Inter-American Investment Corporation and the Japanese International Development Corporation for a tuna exporting operation. The company planned to export sashimi-grade tuna and shark fins. (Presumably swordfish and other billfish were also involved.) The company had hoped to acquire additional vessels, presumably longliners, equipped with freezers and to build a processing plant at Paita.[324] The result of fishing operations, however, were largely disappointing.[325] Consorcio Pesquero is one of the few Peruvian company that the authors have confirmed were operating commercial tuna longliners during the 1990s. (Also see "Pesquera Atlantis" and "Tuna Latin".) Consorcio Pesquero participated in the 1996 IDB-longline training program. (See "Foreign Aid.") Results of its longline operations, however, proved disappointing. The company was one of the least profitable PPP/Grupo Sotomayor affiliates and, as a result, was closed in 1997 as part of a general restructuring. The Consorcio's assets were absorbed or sold by PPP. All highseas fishing operations ceased and efforts to export sashimi-grade product to Japan were terminated. The *Paloma* was sold to a foreign company and the *María Jose* to Cazamar.[326]

Faenas Portuarias: This company provides port services in various Peruvian ports. The company assisted the first Spanish longliners enter the ETP-longline fishery in early 1989. Unconfirmed reports suggest that the company was no longer operating in 1996.

Gloria: This company is best known in Peru as a producer of milk. It also buys canned fish and markets it in Peru under its own label. The company reportedly handles tuna fillets, but only canned product. It does not operate any fishing vessels.

Grupo SIPESA: See Sindicato Pesquero.

Grupo Sotomayor: This company is an important producer of fishmeal and canned fish. The company decided in the early 1990s to enter the tuna longline fishery through a subsidiary, Consorcio Pesquero. (See "Consorcio Pesquero" for details.) The results, however, were disappointing. Catches were substantially below the levels expected. Grupo Sotomayor decided in 1997 to close the operation when their Japanese partner could not meet needed financial contributions. The three longliners have either been sold or are idled in port.[327]

IBC: IBC processes a wide range of seafood at its freezing plant located in Paita. Production is primarily demersal species, but some pelagics are also produced, including bonito, mako shark, and dorado.

Industrias Pesqueras Daruma: This company deploys a few small artisanal vessels using small longlines and driftnets. They reportedly handle, among other commodities, some tuna.

Japan Tuna del Peru: Japanese tuna fishermen (Nikkatsuren) in 1993 established this company to provide ship agency services to members operating longliners with SEC.

Luming: This company reportedly works with artisanal fishermen targeting sharks. They handle, among other commodities, some shark fins.

(R.) Muelle: This Callao-based company offers various shark products such as cartilage and leather.

PEPESCA: The state-owned fishing company Peruana de Pesca (PEPESCA) attempted to launch tuna purse-seine operations during the 1970s. PEPESCA launched a $25-million program in 1973. As part of that effort, the company acquired four large (1,000 ton seiners), two in "kit" form. Some optimistic reports were published.[328] The effort, however, proved disastrous and massive deficits were incurred.[329] The vessel "kits" were never fully assembled by PEPESCA. The company was closed and its assets sold in the 1980s.[330] Two of the vessels were launched and have been afloat, idled in the Bay of Paita for several years (photo 8). The other two were in the SIMA shipyard for several years. The company made another effort to enter the tuna fishery in the mid-1980s during the APRA Administration. The results were another series of massive annual losses. The company's tuna seiners were first sold to Atunera Bolivariana in 1988 and subsequently to Pesquera Austral in 1994.

Pesquera Atlantis: This company reportedly purchased three Japanese squid jiggers which they converted for longlining. The three vessels were: *Andrew* (formerly *Yahata Maru*), *Christopher* (formerly *Hoyoshi Maru 5*), and *Rossie* (formerly *Konpira Maru 3*) (appendix A2). The vessels were purchased in December 1995 from the North Japan Maritime Corporation and the Peruvian Embassy in Tokyo granted them a temporary Peruvian registration. They were outfitted with longline gear in Hawaii during January 1996. The vessels have been deployed off Peru in operations targeting primarily bigeye tuna. The primary market is Japan. Some of the catch is shipped fresh to Japan and there are also frozen shipments. Operations continue in 1997, but the have reportedly not proven as profitable as company officials had hoped.

Pesquera Austral: The company in 1994 purchased the four partially completed tuna purse seiners that PEPESCA had ordered during the 1970s. Pesquera Austral planned to deploy them in the jack mackerel fishery.[331]

Pesquera Eraz: A group of Peruvian investors affiliated with TRAMARSA purchased a small longliner, *Eraz I,* in 1996. It is the first Peruvian-built longliner. The vessel has been deployed for fresh fish operations out of Ilo. The 25-GRT vessel is 14 m long and 4 m wide. It has a 25-ton refrigerated hold, and an autonomy of about 15 days. Operations are conducted primarily within the Peruvian 200-mile zone. The initial operations used bottom longlines to target Patagonian toothfish ("mero/bacalao de profundidad") and other demersals. The company focuses on actual fishing operations and sells the catch to other companies more experienced with export marketing.[332] Company representatives report that warmer water temperatures in 1997 have reduced the demersal catch and they plan to redeploy the vessel with surface longlines for mako and other sharks.[333]

Productos Pesquero Peruano (PPP): PPP is the fisheries division of Grupo Sotomayor and was the parent company of Consorcio Pesquero. The Consorcio was one of the few Peruvian companies which conducted commercial longline operations for tuna and swordfish. (See "Consorcio Pesquero".) Results proved disappointing and PPP suspended longline operations and closed the affiliate in 1997.[334]

Refrigerados Iny: This company, among other commodities, handles tuna.

Ribar: Ribar operates Peru's most modern seiner fleet, the country's only all-refrigerated fleet. It also has some of the most modern fishmeal and canning plants in Cuboid and Paita. The company primarily targets jack and horse mackerel and sardines, but in 1992 was studying the possibility of initiating tuna operations.[335]

Servicios Ejecutivos Comerciales (SEC): Japanese tuna fishermen (Nikkatsuren) in 1987 established the SEC joint venture in Callao. The Japanese partner was Japan Tuna (based in Panama). The Peruvian partner was M. Woll.

Servinave: This Callao-based company was established by Japanese tuna fishermen (Nikkatsuren) in 1989 to recruit Peruvian fishermen to work on Japanese tuna longliners.

Sindicato Pesquero (SIPESA): Sindicato Pesquero was established in 1945 and is one of Peru's oldest and largest fishing companies. It is associated with Grupo SIPESA. Initially it was involved in canning operations (bonito, sardines, and other species). The company began producing fishmeal in 1967-68 and they are now the leading fishmeal producer in Peru and perhaps the world (photo 22). Sindicato Pesquero operates 8 fishmeal plants and 65 purse seiners. It has a pier at Paita and its nearby processing facilities (fishmeal, canning, and freezing) at Tierra Colorado are the largest plant in Paita.[336] The company has been diversifying its operations and in July 1995, deployed two longliners, *Pionero* and *Audaz* in the bottom longline fishery for Chilean seabass (Patagonian toothfish). These vessels are 18-m long and deploy longlines at depths of up to 1,800 meters. The company exports all of its catch of seabass fresh to the US, mostly to Seattle. Bottom longline operations for seabass have been affected in 1997 by warming water temperatures. Seabass and other demersal catches have as a result declined. Sindicato Pesquero has ordered the construction of three, 20-m longliners (*Triunfador*, *Pionero 1*, and *Audaz 1*) to

target swordfish. SIPESA decided to focus on coastal swordfish vessels, in part because the vessels were less costly and more economical to operate than tuna vessels which need to be larger vessels with a wider operating ranges. The vessels were designed in SIPESA's Fleet Division and Office of Studies and Execution of New Fishery Businesses based on the design of Spanish longliners. They are equipped with U.S. manufactured gear (Lindgren-Pitman). Sindicato Pesquero has contracted an experienced Chilean captain to provide technical assistance for fleet operations. They have decided to pursue swordfish in 1997 as prices for fresh product are favorable on the U.S. market.[337] Plans initially entailed deploying these vessels in November 1997, but the warming sea surface temperatures off Peru in mid-1997 have caused swordfish and billfish (especially sailfish) to appear in unusual quantities close to the coast. As a result, the company has begun to target swordfish (appendices B8 series). SIPESCA also moved up deployment to June 1997. They have to deployed these vessels in grounds along the Peruvian coast from out of Callao, Paita, and Pisco, both inside and outside the 200-mile limit. The focus was to be primarily on northern grounds off Paita and southern grounds off Ilo. Company officials note, however, that because of the abnormally warm 1997 water temperatures, swordfish are available all along the coast. The early results in mid-1997 have shown the best results out of Ilo off the southern coast (appendix B8a1). The hold capacities of the new vessels are 70 cubic meters or 40 tons of fish. They were being built in the small Transmar Luz S.A. shipyard in Callao. The vessels are some of the few active Peruvian vessels targeting swordfish or tuna in a directed fishery.[338]

Trabajos Marítimos, S.A. (TRAMARSA): TRAMARSA is a shipping company located in Ilo. It is the largest Ilo-based company handling transshipments. The company was formed as a joint operation between the Chilean Sudamericana de Vapores shipping company and the Peruvian Romero Group. The company works with foreign fishermen from various countries, especially Spain (photo 48). TRAMARSA helps the Spanish and other foreign fishing companies to recruit and place local crew members. The company has placed more than 100 crew members on Spanish vessels. TRAMARSA assists with the transshipments of the catch (photo 51). TRAMARSA reports that Spanish vessels first called in Ilo in 1989 and were active through 1993. Spanish activity has since tapered off. There was much reduced activity in 1994 and none in 1995. A few Spanish fishermen returned in 1996 and reported better catches. The authors have identified five Spanish longliners operating in the Pacific out Ilo during 1996 and transshipping through Peruvian ports (appendix A2). Two Spanish longliners have been identified in 1997. The authors do not have a complete list and more Spanish vessels may have been active. Investors affiliated with TRAMARSA built a small longliner at an Ilo shipyard in 1996.[339] (See: "Pesquera Eraz" above.)

Tuna Latin: Tuna Latin is the private Peruvian company with the longest history of attempting to enter the ETP tuna fishery. The company's efforts, however, have been significantly affected by political changes and resulting shifts in the regulatory structure. José Koechlin and other Peruvian investors established the company in December 1979 to launch a new domestic tuna fishery. A very large number of Japanese longliners were operating off Peru and other ETP countries during the late 1970s. tuna Latin representatives estimate the number of Japanese longliners during this period at about 150 vessels.[340] The northern Peruvian coast off Tumbes/Piura appears to have been an especially important ground. Koechlin felt that Peru should participate in the lucrative fishery being conducted off its coast and carried out a feasibility study. Investors were encouraged in 1979 by the more open economic policies of President Fernando Belaúnde after years of a leftist-leaning military dictatorship. MIPE in 1984

***Photo 51**.--TRAMARSA is the Ilo-based shipping company assisting Spanish longliners operating in the southeastern Pacific. J. Echeandía Zegarra*

Photo 52.--Bigeye tuna and swordfish landed by the Japanese tuna longliners operating with Tuna Latin. Máximo Collao Castro

licensed 144 Japanese longliners for operations within Peruvian waters. Tuna Latin representatives estimate bigeye, the target species, catches at about 70,000 tons.[341] Drawing on his feasibility study, Koechlin decided to launch a domestic tuna longline fishery. He acquired Peru's first tuna longliner when in 1980 he purchased the *Tokujio Maru* and renamed it the *Inca Mar* (appendix A2 and photo 53). As Peru had no domestic tuna regulations, Koechlin worked with MIPE officials who in 1982 issued needed regulations, "Reglamento para la operación de los buques pesqueros atuneros frigorificos." The most important element of these new regulations was the creation of a reserved area ("Zona de Reserva") off northern Peru near Bayovar (7°S-to the Ecuadorean border and 82°W).[342] Only Peruvian-flag vessels were permitted to operate in the reserved area to help Peruvian investors enter the new fishery. Tuna Latin established its main offices in Lima (Miraflores), but fishing operations were conducted out of Paita. Tuna Latin attempted to purchase six additional Japanese longliners, but MIPE never acted on their request. Fisheries Minister Alejandro Deustua instead decided to open the reserved zone to foreign longliners. MIPE issued 20 licenses to Japanese longliners. The licenses were nominally charter agreements with what some observers describe as Peruvian "straw" companies, most with no fisheries experience or significant capital. As a result, Tuna Latin dropped its effort to purchase longliners and instead signed charter agreements to operate initially 4 Japanese longliners and eventually 14 longliners. The arrangements were made with Japan Tuna.[343] Tuna Latin worked with the Japanese longliners through 1985, despite the appointment of a new fisheries minister, Ismael Benavides, and further changes in the regulations rasing the fees and changing the nature of the contracts. A change of Government in 1985 brought President García and the populist APRA party to power. President Garcia's new Administration modified existing regulations (such as the reserved fishing zone off Bayóvar) and canceled many contracts with foreign companies (such as Tuna Latin's association contracts). These actions combined with a disappointing tuna season, forced Tuna Latin to cease tuna operations and instead shifted to hake. The *Inca Mar* was converted to a floating cold store (photo 53).[344] Attempting to take advantage of the more open market policies of the Fujimori Administration, the company made another attempt to enter the tuna fishery in 1992. During the term of office of another fisheries minister, Jaime Sobero Taira, Tuna Latin leased seven Japanese longliners with a 5-year purchase option (appendix A2). Initially the crews were 80 percent Japanese, but by the time the vessels were sold to Tuna Latin, about half the crew was Peruvian. Tuna Latin obtained MIPE approval for the 5-year leasing program at the end of which the vessels would be incorporated into

***Photo 53**--Tuna Latin's vessel Inca Mar is now used as a floating cold store. Here some small trawlers are delivering their hake catch. Maxima Collao Castro*

the domestic fleet. MIPE issued 1-year licenses that could be renewed. Company officials reported that the cost of purchasing the vessels would have totaled $35 million over the 5-year period. Unlike leasing arrangements in other Latin American countries, the contract provided for the eventual purchase of the vessels. In addition, the lease/purchase agreements were not profit sharing arrangements. The vessels were to be operated by Tuna Latin which after paying the lease/purchase fees accrued the profits or was responsible for the losses. Tuna Latin was, however, only able to operate the vessels for about 14 months. Catch of both bigeye tuna and swordfish were reported (photo 52). The arrangement proved controversial and the Government in 1993 refused to renew the fishing licenses for the Tuna Latin vessels. Company officials attempted to work with MIPE to allow the vessels to operate, but MIPE officials were adamant. MIPE in 1993 issued new regulations ("Plan de ordenamiento pesquero del atun, especies afines, y asociados"), which, while not specifically identifying Tuna Latin, had a significant adverse impact on the company's operations and forced them to discontinue leasing arrangements.[345] As a result, Tuna-Latin had to suspend its operating plans and attempted to renegotiate the contract with the Japanese. In the end the company had to return the vessels after having made sizeable non-refundable payments. Other Government regulations, such as increasing import duties on fishing vessels to 42 percent, make in virtually impossible to import foreign longliners to initiate a domestic longline fishery. The company currently uses the *Inca Mar* as a mothership or floating cold store in the hake fishery (photo 53). It also operates small fishing boats which deliver their catch (mostly hake and tuna, but rarely swordfish) to the *Inca Mar* (photo 53). Given the difficulties experienced with fisheries, the company is closing many of its fishing operations and trying to sell the *Inca Mar*. They retain some of the small artisanal trawlers deployed in demersal trawl fisheries for hake out of Paita.[346]

Unknown: One observer indicates that another company made arrangements with a Japanese company to operate the *Taisei Maru 1*, a 48-m longliner with a 400 t hold. This was the last Japanese tuna vessel leased by the Peruvians and its lease expired in 1994 (appendix A2).[347]

XII. Markets

A. Domestic

Little swordfish is currently marketed in Peru. Most of the small swordfish catch taken in the country's erratic longline fishery is exported and only small quantities (primarily lower quality product) is marketed domestically. The artisanal catch is largely marketed fresh in domestic markets, but the quantities involved are very limited. Government officials report that domestic consumers are unfamiliar with the species and it needs to be promoted to provide a better market for the fishermen.[348]

Swordfish in Latin America is normally exported, but the current artisanal landings are often not of sufficient quality to export. In addition, the limited, inconsistent supply makes it difficult to establish reliable marketing channels, a critical factor when dealing with fresh product.

Most of the current artisanal catch is landed at Paita and small artisanal ports near Paita (appendix B3d2). It is sold at the dock for eventual sale as fresh product in local markets. Often the fish is sold at fresh fish counters in central markets, but some fish may also occasionally be found in supermarkets. Some swordfish is landed frozen in Peru by licensed foreign vessels or transshipped by unlicensed vessels, but this product, with the exception of non-export grade fish, does not enter the domestic market.

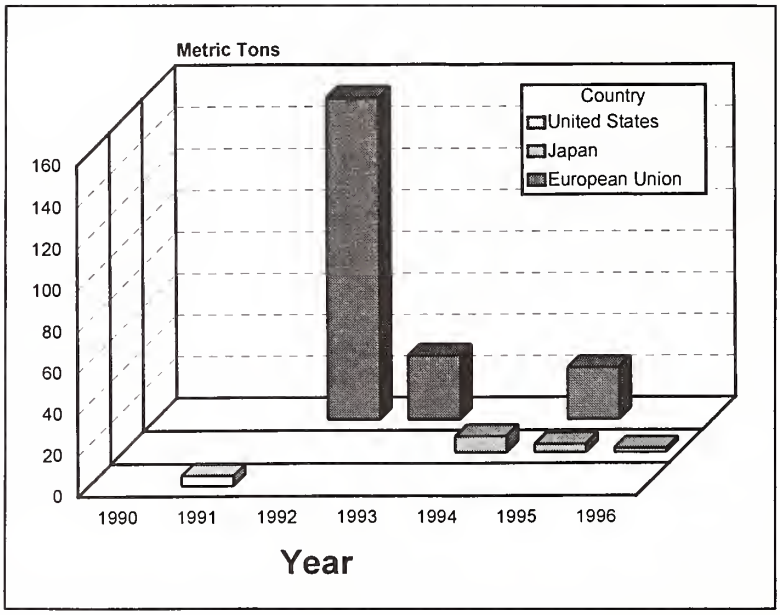


Figure 20.--The European Union swordfish imports were almost all marketed in Spain.

B. Trade

1. Exports

Peru was the first South American country to export significant quantities of swordfish. Swordfish shipments were first noted in the early 1940s during World War II, although few details are available. Significant shipments of frozen product began after the War. U.S. tuna boats began to freeze swordfish delivered by artisanal fishermen. The higher prices offered prompted the fishermen to rapidly increase effort. (See "Catch".) This enabled the fishermen for the first time to target lucrative foreign markets. Exports reached significant levels from 1947-52, but then declined sharply (appendix B2a). Almost all of the exports were shipped frozen to the United States.

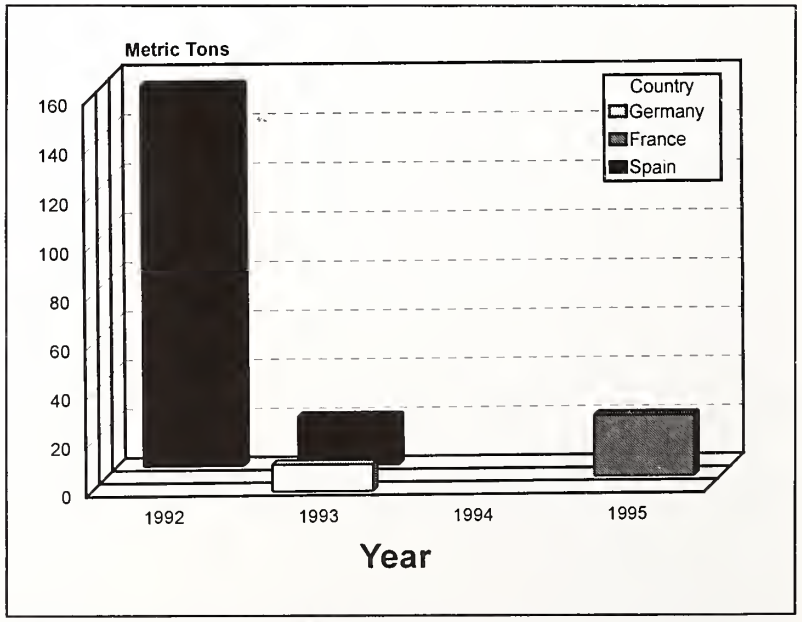


***Figure 21.**--Peru exports very little swordfish. The shipments to the European Union may be Spanish-caught fish.*

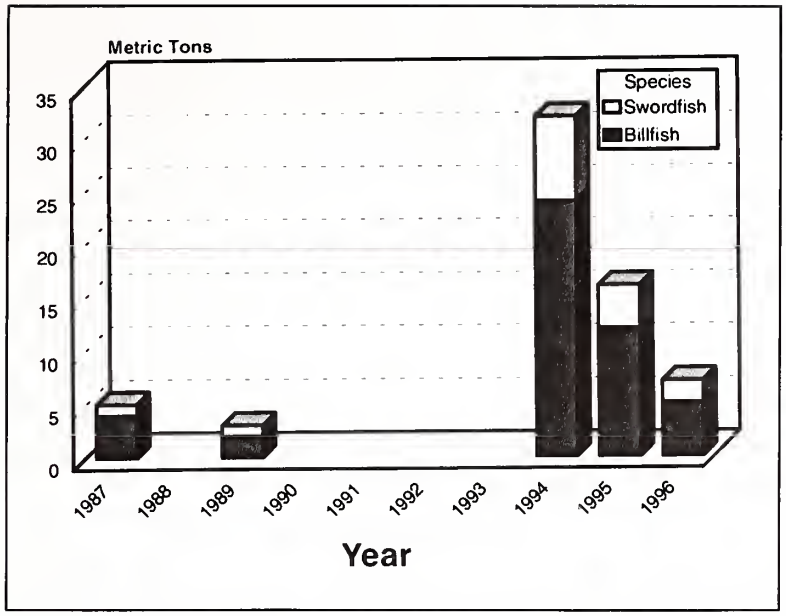


Figure 22--Billfish shipments to Japan probably included only small quantities of swordfish.

Swordfish exports in recent years have declined to extremely small quantities.[349] Peruvian exporters contacted about swordfish during the 1980s indicated that they were unable to supply the species on a dependable basis.[350] The situation during the 1990s was little changed. Some Peruvian groups during the 1980s and 1990s have attempted to promote an export fishery for swordfish, but so far with little success. The limited and irregular supply and the relatively poor quality of fish delivered by artisanal fishermen make it difficult to develop reliable foreign clients. Reported incidents of cholera have further complicated the ability of Peruvian companies to successfully market seafood overseas, especially fresh seafood.

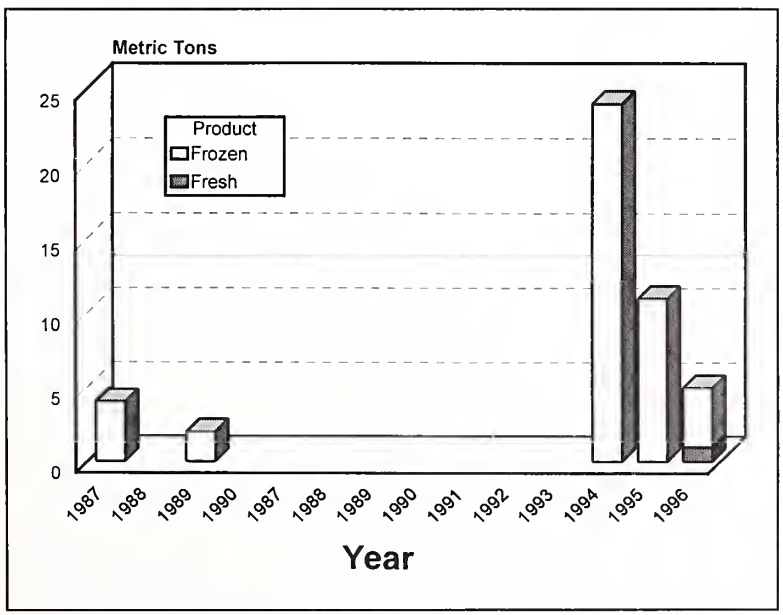


Figure 23--Almost all Peruvian billfish exports to Japan are frozen product.

Peruvian swordfish exports during the 1990s have been minimal. Shipments have been as low as 5-8 t (appendix E2 and figure 20). Reported EU shipments (primarily to Spain) reached 155 t in 1992, but this is probably because Spanish transshipments were incorrectly identified as Peruvian product (appendix E3 and figure 20). Small quantities of swordfish exports during the 1990s have been shipped to the United States and Japan (appendix E2a1 and E4a).

European Union: Large shipments of swordfish were reported to the EU in 1992 (155 t) and smaller quantities in 1993 and 1995 (31 t and 25 t) (appendix E3 and figure 21). All of the 1992 shipments and most of the 1993 shipments were marketed in Spain. Negligible shipments were reported in 1994 and none at all in 1995. The authors believe that some, if not most, of this product may be swordfish taken by the Spanish-flag longliners operating in the Pacific rather than product landed by Peruvian vessels (photos 36-46).[351] (See: "Transshipments" and "International.") The EU imports, especially the 1992 shipments, substantially exceeded Peruvian catches. In addition the shipments appear to reflect the level of Spanish activity in the Pacific. (See "International".)

Japan: Peruvian companies ship very limited quantities of swordfish and billfish to Japan (appendix E4a and figure 22). Japanese import statistics indicate there were no such shipments in the early 1990s and that shipments in 1994 and 1995 totaled only 24 t and 12 t, respectively (appendix E4). As the Japanese lump swordfish with other billfish in a combined basket category, actual swordfish shipments are even less, perhaps only a third of the total. Almost all of the Japanese shipments are frozen (appendix E4b and figure 23). The Consorcio Pesquero in 1995-96, working with Japanese partners and the IDB, hoped to begin surface longlining to supply high-quality sashimi grade tuna and swordfish for Japan. This project could have significantly increased exports. The project, however, was unsuccessful. (See: "Companies," "International," and "Foreign Aid.")

United States: The United States, which played a key role in developing

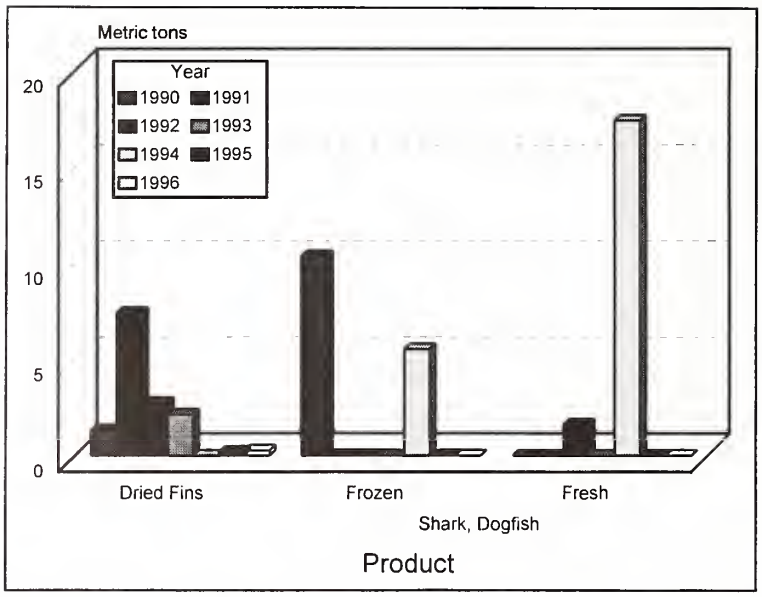


Figure 24.--Peruvian swordfish exports to the United States have varied widely, but have been negligible since 1991.

the Peruvian swordfish fishery before and after World War II, became the principal market for Peruvian swordfish. Shipments were reported during the war (1941-45).[352] Little information is available on the trade during the war years, but it may have been primarily canned product as Peru at the time had no fish freezing plants. After the War, U.S. tuna seiners began operating off Peru. The vessels had freezers and several were deployed as motherships for swordfish delivered by artisanal fishermen. Access to freezers for the frozen swordfish allowed Peruvian companies to enter the U.S. market. The increased prices offered for the fish greatly stimulated artisanal effort and catches soared (appendix B2a). During the high point of the harpoon fishery in the late 1940s and early 1950s, most of the catch was exported to the United States. One estimate suggested that exports peaked at 2,600 t in 1950; other estimates are substantially higher (appendix B2a). (See "Catch".) Since the early 1950s, exports to the United States have declined significantly. Shipments during the 1970s were minimal (appendix E2a1 and figure 24). Peruvian swordfish exports to the United States in recent years have been very limited. Small quantities of up to 11 t were shipped during the 1980s. About 5 t were shipped in 1991, but shipments since then have been negligible or non-existent--less than 1 t in 1994 and 1996 (appendix E2a1). Peruvian exporters have been attempting to expand shipments of high quality fresh fish to the United States during the 1990s. Overall shipments of fresh fish increased from $0.1 million in 1990 to $2.9 million in 1996. Despite this increase, oceanic pelagics such as swordfish and tuna shipments are still very modest. Shipments of oceanic pelagics generally are only a small part of fresh shipments. In addition there is no observable trend showing that the Peruvian companies are successfully producing and exporting fresh product. Peruvian swordfish exports to the United States peaked at $39,000 in 1991 and tuna exports peaked at $150,000 in 1994 (appendix E2c). The source of that product is unknown, but as it is fresh product it would presumably be domestic Peruvian, probably semi-commercial artisanal, fishermen. Shipments declined sharply in 1995, but recovered somewhat in 1996 (appendix E2c).

It is difficult to predict future export trends because of the lack of information on the status of the stock. Peruvian fishermen, often associated with foreign groups, have attempted to expand the longline fishery. The focus has been primarily on tunas. A commercial tuna longline fishery would also take swordfish. Peruvian companies (like Consorcio Pesquero and Tuna Latin) have had considerable problems launching the fishery. The ability of the Japanese and Spanish to catch tuna and swordfish confirm that there is an available resource. There is no reason why a well-managed, adequately capitalized Peruvian company could not succeed. The Government's more open economic policies are now making it possible for private companies to commit capital for such new ventures. Peruvian investors now appear to be less interested in large commercial freezer longliners than operations for fresh fish conducted by smaller, less expensive vessels. One company (Pesquera Atlantis) in 1997, however, is operating large commercial longliners.[353] This operation and the decision of a large well-established company (like Sindicato Pesquero) to deploy small longliners for swordfish in mid-1997 suggests that Peru could begin exporting small quantities of swordfish and other oceanic pelagics by the later part of the year.

2. Imports

Peru does not import swordfish.

XIII. Government Agency and Policy

A. Fisheries agency

The Peruvian agency responsible for fisheries is the Ministerio de Pesquería (MIPE).

B. Fisheries law

The basic Peruvian fisheries law is the Ley General de Pesca of 1992.[354] The law represents a major revision of Peruvian fishery laws and regulations and provides the basis for managing Peruvian fisheries. It includes provisions on a wide range of fishery matters, including management, research, vessels, marketing, and aquaculture. It also establishes the Fondo Nacional de Desarrollo Pesquero (FONDEPES) to help finance fishery development projects. The law permits foreign fishermen to obtain access to Peruvian grounds and provides detailed provisions to regulate foreign operations.[355] (See "Licenses," below.)

Peru currently has no specific regulations governing the swordfish fishery. The species has been of minor importance to MIPE given the minimal landings in recent years. Some observers, however, are concerned over unconfirmed reports that foreign fishermen are taking large quantities of juvenile swordfish and landing or transshipping them at Peruvian ports. While there are no specific swordfish regulations, the species is in part covered by Peru's tuna management plan.

Peru implemented a management plan for tuna and related species ("especies afines") in 1994.[356] The plan indirectly covers swordfish as they are one of the associated species. A quota of 6,000 t was set for 1994-95. The Peruvian regulations are very strict and involve substantial access fees for tuna vessels. The Government requires fees based on the vessel's capacity. (See: "Licenses" below.) The vessels are prohibited from fishing in a 30-mile (48 km) coastal zone reserved primarily for artisanal fishermen. The Government also requires a Peruvian inspector on each vessel to collect data and help enforce regulations. The Government sets percentages of maximum capture of by-catch species. A fisherman with a valid tuna license, for example, is only permitted a 5 percent by-catch of other species.[357] If the by-catch is above this limit, the excess by-catch is confiscated and fines are levied ($1,000-$50,000).[358] Harpoon fishing for marlin and several other species
are prohibited.

C. Limits

Peru declared a 200-mile Territorial Sea in 1947 by a Supreme Decree and reconfirmed that declaration through subsequent laws and constitutional articles.[359] Peruvians refer to their 200-mile zone as the Mar de Grau in honor of a 19th century naval hero. The United States, which recognizes 200-mile Exclusive Economic Zones (EEZs), has protested the Peruvian 200-mile claim as it is a Territorial Sea claim. Peru has negotiated marine boundary agreements with both neighboring countries, Chile (1954) and Ecuador (1975).

D. Management

Peruvian officials have given considerable attention to possible new management systems. Officials are especially concerned about the expanding effort on the key anchovy stock, understandable given the importance of the stock and past history of wide fluctuations. Some foreign advisors, especially from the World Bank, have suggested promoting limited entry systems, such as individually transferrable quotas (ITQs).[360] The issue has engendered considerable debate in Peru. FAO specialists have also advised MIPE. An FAO team visited Peru during August 1995, to help evaluate the MIPE management plan. Many industry representatives object to the proposals and have expressed concern that such a sophisticated new system would provide considerable possibilities for cheating. The Sociedad Nacional de Pesca (SNP) characterized the management proposals a potential "disaster." Richard Díaz, SNP General Manager, labeled the ITQ proposal as disguised fees and taxes. He said that "If a tax is all they have to offer us, our answer is no, and if that is all they have to say to us, then the plan to re-order the fisheries sector is a disaster."[361] Most industry representatives appear satisfied with the current system which involves periodic closures. Such a system of completely closing the fishery makes it easier to enforce and assures the different companies that their competitors also have to cease operations. Thus it appears unlikely that Peruvian officials plan to embark on any sophisticated new management system, at least while catch rates continue at acceptable levels. MIPE is considering other options including fees and contracting a private company to monitor catch levels.[362]

E. Promotion

The Fujimori Administration has attempted to stimulate investment in the private sector and made many guarantees to investors.[363]

- Tax, currency, exchange rate, and administrative stability for 10 years.
- Taxes apply only to dividends distributed
- Taxes on production to be deducted from income taxes
- Right to remit profits abroad and free access to foreign currency
- Administrative simplification
- Investment guarantees
- Accelerated depreciation up to 5 years

The Administration published its fishery development policy in 1994 which included, among other matters, a commitment to acquire and designate information needed by domestic and international investors to plan fishery projects.[364] Attracting private domestic and foreign investment is critical for the industry's development. Not only does the Administration not have the financial resources for adequately funding needed improvements, but it believes that such investments may not be in the industry's long term-interest--especially investments in state corporations. The Fujimori Administration sees the efforts of previous administrations to promote development through state corporations as part of the reason for Peru's dreadful economic performance during the 1980s-90s. The Administration does, however, see a Government role in funding small, narrowly focused projects. The Ley General de Pesca established FONDEPES to promote and execute commercial fishery development projects by providing technical, economic, and financial support. FONDEPES is funded primarily through MIPE.[365]

The Peruvian Government has decided to give increased attention to promoting improved quality control standards in the fishing industry. Given the importance of the fishing industry to Peru, both for supplying food to the domestic market and generating foreign exchange earnings, such a decision is critical. Ing. Jorge Villena Chávez, Director General de Salud Ambiental in the Ministerio de Salud in 1996 addressed the subject of quality standards at a regional FAO meeting dealing with fishery products. He announced that the Peruvian Government at the "highest level" has decided to ensure that Peruvian fishery products are of the highest quality standards and described the national program to achieve that objective.[366]

F. Licenses

Peru had a very active program of licensing foreign tuna fishermen during the 1970s and 1980s. The number of licenses issued peaked at 144 in 1980. Licensing and other access arrangements, however, have proven very controversial in Peru.[367] The licensing regulations, as a result, have changed significantly from year to year. Policies have varied from a developmental focus using licenses for generating funds and acquiring foreign technology to an essentially exclusionary focus achieved by setting licensing (access) fees at prohibitively high levels. The number of foreign companies applying for fishing licenses has declined significantly in recent years, primarily because of fee increases.[368]

1. Regulatory framework

a. 1982

The Government in 1982 established a reserved zone off extreme northern Peru for Peruvian-based vessels.[369] The regulations were reportedly written primarily to benefit one company, Tuna Latin. The licensing regulations provided for:

Vessels: The size of foreign vessels were limited to 250 tons.

Fees: Fees were increased to $160-320 per GRT, depending on how close to the coast the vessels were deployed.

Zones: An exclusive 30-mile (48-km) coastal zone was established for domestic fishermen. Foreign fishermen could operate in a 30-60 mile (50-100 km) coastal zone, but had to pay higher fees than in the 60-200 mile zone.

Crew: Crews members had to be primarily (not less than 20 percent) Peruvian nationals.

Status: The foreign vessel owners had to sign association or joint venture agreements.

Catch: At least 30 percent of the catch had to be landed in Peru.[370]

b. 1984

New regulations were implemented in 1984 which provided for:

Domestic landings: At least 30 percent of the catch had to be landed in Peruvian ports and sold at national prices (article 8 and 19).

Status: Foreign fishermen could either purchase a fishing license or sign a leasing contract with a Peruvian company (article 11).

Fees: Fishing fees included a registration ($2,000), navigation permit ($20 per GRT), and fishing permit

($160 per NRT) (article 13).
Duration: Leasing contracts could extend for 12-month periods (article 18).
Zones: Foreign and national vessels had to fish outside a 30-mile coastal zone, except for a special northern area (article 24).[371]

c. 1985-88

Several changes were reported during the mid-1980s. The new APRISTA Administration in 1985 rescinded the reserved zone. Further changes to these regulations were made in 1987 and 1988.[372]

d. Early 1990s

Tuna Latin leased foreign longliners again in 1992, but the Government refused to allow them to renew the licenses after 1993.[373] The operation of foreign vessels off Peru, especially large stern factory trawlers, has proven very controversial. The 1992 Ley General de Pesca permitted foreign vessels to operate in Peruvian waters, but only in association with Peruvian companies (Article 48). The contractual arrangements can be in various forms of leases, partial ownership, joint ventures, or other types (Article 49).

e. 1994

The Government implemented new licensing regulations for foreign and domestic fishermen desiring to fish for tuna and related species in 1994. The licensing regulations were included in the Government's new tuna management plan.[374]
Fees: Both foreign and domestic vessels were assessed a fee of $500 per net-registered-ton (NRT) for a 6-month license.
Crew: Peruvian regulations required that the crew of licensed tuna vessels consist of at least 30 percent Peruvian nationals.[375]
Duration: The licenses were valid for 6 months.[376]
By-catch: The Government limited by-catches in the tuna longline fishery to 5 percent of the catch of the target species.[377] Fines for violations were set a substantial levels. The Peruvian regulations also prohibited the licensed tuna fishermen from discarding the by-catch at sea and required that it be landed.[378]

f. 1996-97

President Fujimori appointed a new Fisheries Minister in 1996. Alberto Pandolfi Arbulu, who was also appointed Prime Minister, previously headed Peru's oil company (PETROPERU). He replaced long-serving Jaime Sobero. Minister Pandolfi has indicated that he believes that licenses to foreign fishing vessels should only be issued to companies willing to invest in Peruvian shore-based processing plants.[379]

Peruvian officials in 1997 are currently considering various revisions to the 1994 management plan for tuna and associated species. Some of the changes under consideration are:
Species: Ministry officials are considering the issuing of licenses for specific tuna and associated species.
By-catch: The permissible by-catch would be limited to: purse seiners (5 percent) and longliners (20 percent). The vessel owner can retain the by-catch within these limits. Any by-catch exceeding these limits must be donated to MIPE.
Fees: The licensing fee for domestic fishermen may be reduced. Some officials are concerning charges of about $170 per NRT.
Fines: Fines for exceeding the by-catch limits and other infractions may be reduced.[380]

2. Fishing licenses

The number of tuna licenses issued to foreign fishermen has declined significantly during recent years.[381] The increase in the cost of the licenses appears to have been the principal reason. The number of licenses issued to foreign longliners fell from six in 1992-93 to only two in 1994 (appendix G3). One unconfirmed report suggests that four or five foreign tuna vessels were licensed in 1995-96.[382] Such numbers are only a small fraction of the numbers of vessels that purchased licenses during the 1980s. (See "International".) Most of the tuna licenses issued to foreign fishermen during the 1990s have been issued to Japanese longliners. Almost all of the foreign longliners known to the authors as having operated with Peruvian licenses have been Japanese vessels. Virtually all of these licenses, however expired in 1993 (appendix G2).

The licensing of foreign fishing vessels is a contentious issue in Peru. Some Government officials and industry groups promoting development as well as companies working with the foreign fishermen have favored the licensing program. Other industry groups not benefitting from the foreign effort as well as most fishermen are critical. Fisheries is one of the country's principal resources and discussions of industry issues are often highly politicized. Some nationalistic politicians have been especially vociferous in criticizing the licensing of foreign vessels. As a result, fees are sometimes set to demonstrate nationalistic fervor rather than on an assessment of the intrinsic values involved.

Businessmen who have attempted to work with the foreign companies have been especially critical of constantly changing regulations.[383]

Critics: Some Peruvian fishery experts have criticized foreign companies, claiming that they were not interested in training Peruvian fishermen.[384] Some of the language used in the debate is highly emotional and nationalistic. The foreign parties involved, for example, are sometimes referred to as "imperialists."[385] Others sometime refer to the foreign fishermen as "pirates".

Proponents: Other Peruvian analysts believe that the high fees established in 1994 are counter productive. One observer believes, for example, that foreign investment and technology are necessary to successfully initiate a domestic tuna fishery and that the current high fees are "absurd" and simply discourage foreign investment in Peru.[386] A businessman notes that since the new regulations were adopted virtually no foreign companies have expressed an interest in deploying vessels off Peru.[387]

3. Research licenses

Some licenses are occasionally approved for research fishing. The Ministry of Fisheries, for example, in 1994 approved a 12-month license for the foreign tuna vessel *Connie Jean* to conduct test fishing in Peruvian waters.[388]

XIV. Research

Several Peruvian research institutes and university groups have fisheries research programs. The principal Peruvian research institute working on marine fisheries is the Instituto del Mar. The authors know of no Peruvian research specifically on swordfish. Some Peruvian researchers have done limited work on longlining and tuna.

IMARPE: The Instituto del Mar (IMARPE) is a "decentralized" public institution dedicated to oceans and fisheries research. The law establishing IMARPE accords it "scientific, economic, and administrative autonomy and acts in concordance with the administrative and political objectives of MIPE."[389] IMARPE is the leading fisheries research institute in Peru. IMARPE conducts research on oceanography, fisheries biology, fisheries technology, marine pollution, and biodiversity. IMARPE's research program has focused on the species of greatest commercial importance, especially small pelagics (anchovy and sardine, and mackerels), demersals (especially hake), and other species. Since 1992 greater attention has been given to invertebrates of commercial importance (especially squid) and species of potential commercial importance (deep-water species and sharks).[390] Budget constraints in recent years have severely restricted its research program. IMARPE researchers have done some limited work on sharks and tunas.[391] The authors know of no IMARPE work on swordfish, but there has been some work on longlining oceanic pelagics in general, primarily focusing on sharks and tuna.[392] The 1994 tuna management plan assigns IMARPE the responsibility for initiating a research program for tuna and associated species (including swordfish).[393] IMARPE is pursuing research aimed at diversifying the fishing industry. Current work is reported on sharks, dorado ("perico"), flying fish ("peces voladores" or *Cypselurus heterurus*). IMARPE is particularly interested in promoting the export of flying fish eggs. IMARPE is also conducting longline experimental cruises to assess the potential for bottom longlining for Patagonian toothfish (bacalao de profundidad or *Dissostichus eleginoides*).[394]

ITP: The Instituto Tecnologico Pesquero (ITP) conducts research on capture methods and processing. Some of this work has included oceanic pelagics, especially shark and tuna.[395] ITP is participating in the 1996 Inter-American Development Bank (IDB) longline training program. (See "Foreign Aid".) The authors know of no specific swordfish studies.

UDEP: The Universidad de Piura (UDEP), a public university, is coordinating the 1996 Inter-American Development Bank (IDB) 2-year longline training program.[396] (See "Foreign Aid".)

UNP: The Japanese Government donated a 50-m used longliner, the *Ibaraki*, to the Universidad Nacional de Piura (UNP) which was to be used for exploratory longlining fishing. A U.S. fishing company, Ocean Fresh Seafood (OFS), in 1994 provided financing and technical assistance. The U.S. company financed the refitting of the *Ibaraki* and staffed it with experienced longline fishermen who trained 10-15 students on each trip. The venture planners expected to land 60 t of tuna as well as a shark and swordfish by-catch and donated $0.08 per kg of catch to the UNP. The company had a 1-year contract which could have been extended for 5 years. Results, however, proved disappointing and OFS did not renew the contract when it expired in June 1995.[397] The *Ibaraki* was idled in port during 1996 because of a lack of funds and remained idled in 1997. The UNP had planned to coordinate the IDB-financed 1997-99 longline training program and to execute some of the projects.[398] (See: "Foreign Aid.") Due to a variety of problems, however, IDB finally decided to work with the UDEP.

UNTC: The Universidad Nacional Técnica del Callao has a Programa de Ingeniería Pesquera which grants technical fishery degrees. Researchers at UNTC have done some work on shark.[399]

Some foreign groups have also been involved in research off Peru. Foreign fishermen receiving fishing licenses are required to submit data. This data, however, has not been released to the public and some industry representatives have criticized MIPE/IMARPE for not disseminating this information.[400] IMARPE's budget limitations, however, have severely limited its work.

Japan: The Japanese have reportedly donated longliners to the UNP and other universities, but few details are available.

U.S. fishermen: MIPE uses foreign fisherman to acquire fisheries data. MIPE authorized, for example, the U.S. tuna seiner *Connie Jean* to conduct experimental tuna in 1994 (appendix G2).[401]

XV. By-catch

A. Swordfish and related fisheries

Little information is available on the by-catch taken in tuna, swordfish, and related fisheries for oceanic pelagics. The limited domestic effort suggests that the by-catch is small, although more extensive foreign longlining suggests a more significant by-catch. Government officials report a wide range of species are involved, especially sharks.[402]

Domestic: The Peruvian swordfish fishery was traditionally conducted with harpoons. (See "Fleet Operations and Gear".) The fish were individually selected, and there was very limited by-catch. Presumably a few other species were taken, including an occasional turtle. Given the large number of fishermen involved during the peak of the fishery, such catches could have been of some significance. Peruvian fishermen have in the past few years deployed a few commercial longliners (appendix A2). However they have experienced little success. (See: "Fleet" and "Fleet Operations.") The limited current effort means that the by-catch is also limited. Peruvian artisanal fishermen, however, target species normally taken in commercial longline fisheries (especially shark) and the artisanal effort appears to have had a significant adverse impact on stocks.

Foreign: Foreign longline fishermen are more active. Given the extent of foreign operations, their by-catch would appear to be significant.

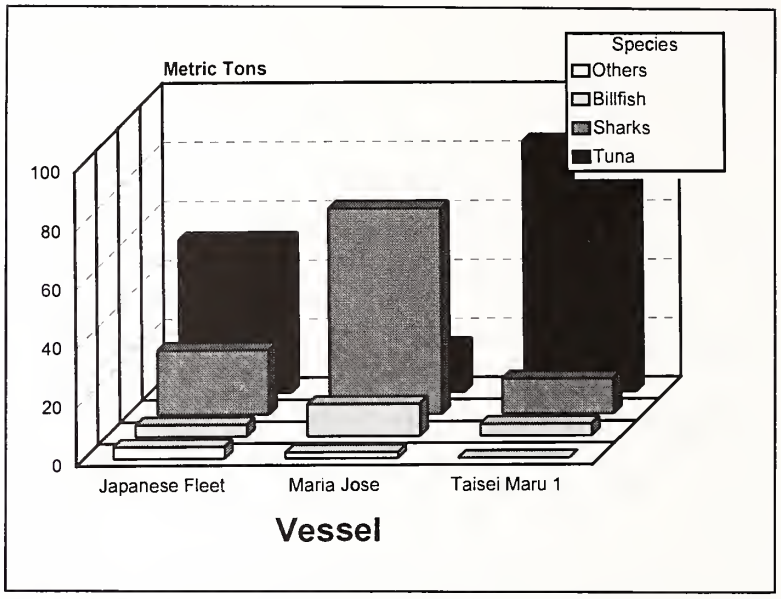


Figure 25.--The Japanese longliners operating off Peru take mostly tuna, but the Consorcio Pesquero longliner Maria José took large quantities of shark.

Peru regulates the by-catch in tuna and related fisheries. There is also an observer program.

Regulations: MIPE in 1994 approved a tuna management plan which covers similar ("afines") species including billfish and swordfish in 1994. (See: "Government Policy" above.) The Government limits by-catches in the tuna longline fishery to only 5 percent of the target species catch.[403] The Peruvian regulations also prohibit the licensed tuna fishermen from discarding the by-catch at sea, requiring that it be landed in Peru.[404] The authors know of no publications describing the by-catch of the longliners licensed by MIPE. There are also regulations protecting turtles.

Observers: Because licensed foreign vessels are required to carry observers, some catch data is being collected. MIPE has not, however, published any of the observer data.

The limited catch data available to the authors suggests that by-catches of oceanic pelagic species are significant. The foreign longline effort in coastal and offshore waters for tunas is substantial. Peruvian effort is more limited, but there is a directed shark and ray fishery. The by-catch and directed fisheries include billfish, swordfish, sharks, rays, turtles,

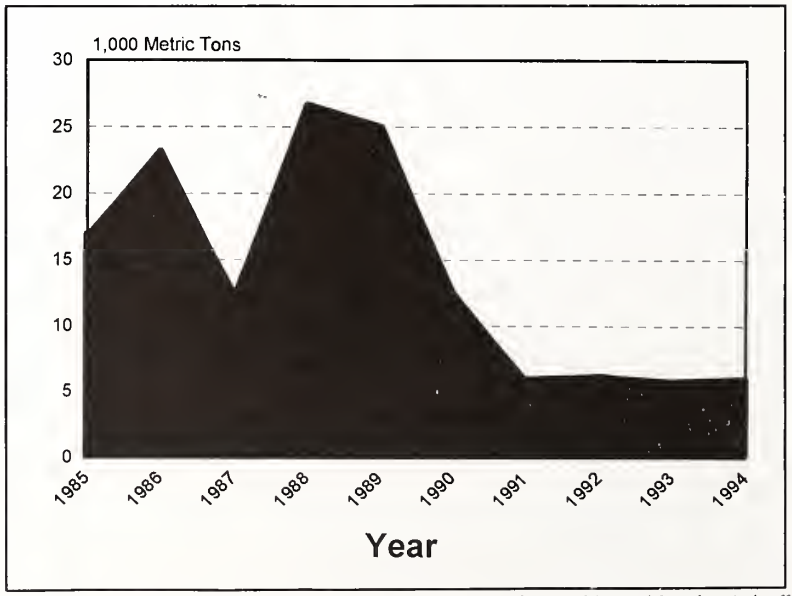


Figure 26.--The Peruvian shark catch plummeted in the late 1980s and has leveled off at only about 5,000 t since 1991.

***Photo 54**.--Sharks landed by artisanal fishermen at Matarani being loaded for shipment to Lima, Peru's principal domestic market. Ednardo Pastor*

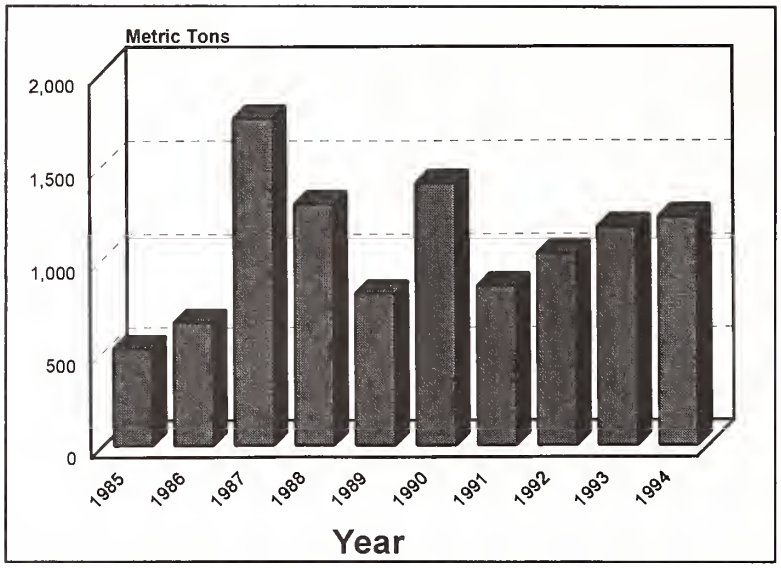


Figure 27.--Japanese and Korean southeastern Pacific shark catches peaked in 1987 at nearly 1,800 tons. Catches in recent years have been increasing.

dorado, and other species. Some of these species are also taken in directed artisanal and small-scale commercial operations. The populations of some species, especially sharks, appear to have declined significantly in recent years.

Available information on by-catch species is as follows:

Sharks: A variety of shark species shark occur off Peru. Government officials report approximately 20 species (appendix H).[405] Shark would be part of the by-catch of any future Peruvian tuna/swordfish longline fishery. Some Peruvian commercial longline operations report very high shark catches. Consorcio Pesquero in 1994, for example, reported that about 70 percent of the *María José* longline catch was shark (appendix B5a and figure 25). The vessels which have begun to target swordfish in 1997 are also reporting substantial shark by-catches, much of which is discarded (appendix B8a2).[406] Peru already has a directed artisanal/semi-commercial fishery for shark and rays. Some of the major species landed are blue ("azul" or *Prionace glauca*), mako ("dinamente/bonito" or *Isurus oxyrinchus*), and hammarheads ("martillo" or *Sphyrna zyganea*).[407] The sharks are used for both meat and fins as well as other products such as cartilage and leather. (See "Processing and Products.") This fishery was of considerable importance to the artisanal fishermen in the 1980s (appendix B5b and figure 26). Catches have fallen sharply in recent years, from nearly 26,600 t in 1988 to only 5,600 t in 1994, but recovered somewhat in 1995 (appendix B5b and photos 34 and 51). Several Peruvian companies process shark and output has also declined sharply in recent years (appendix C3). Heavy fishing pressure and climatic conditions appear to have been responsible.[408] The authors have little data on the foreign operations, but one report suggests that 20 percent of the Japanese catch in the early 1990s was sharks (appendix B2a and figure 25).[409] The Japanese and Koreans have reported small shark and ray catches to FAO in area 87 (appendices B5d and figure 27). The foreign shark and ray catch has not fluctuated nearly as much as the domestic catch. **Rays**: No by-catch data is available on rays, but they are known to be taken in the longline fishery (appendix B5a). The most common species off Peru are sting (*Urotrygon spp.*) and eagle (*Myliobatis peruvians*) rays. Peruvian ray catches have declined even more sharply than sharks. The domestic ray catch totaled 8,700 t in 1989 (appendix B5c and figure 28). Press reports noted a developing artisanal fishery using hook and line ("espinel"). The fishery was concentrated along the southern coast out of Pucusana and sold as fillets primarily in the domestic market, especially Lima.[410] The catch has since

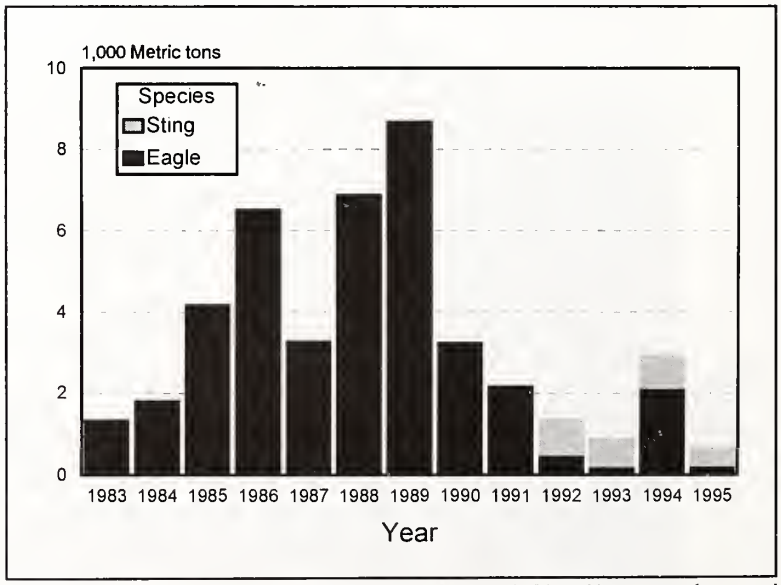


Figure 28.--The Peruvian ray catch peaked at 8,700 t in 1989 and has since plummeted to minimal levels.

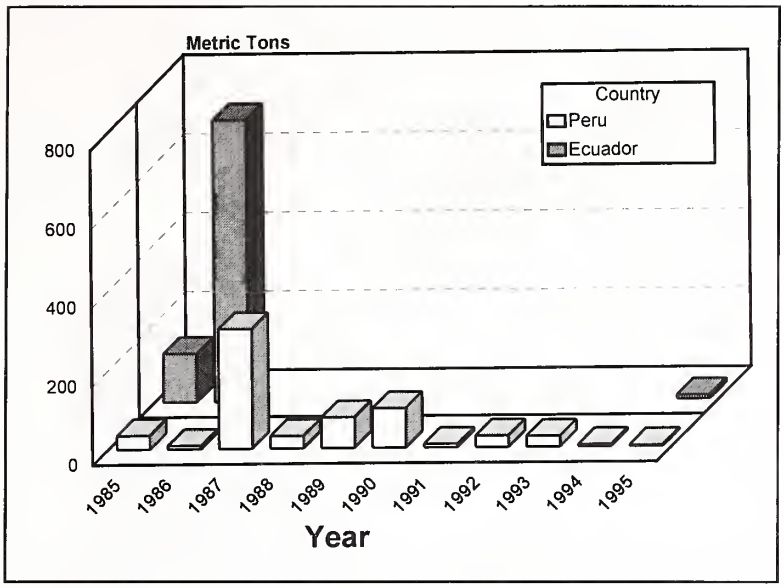


***Figure 29.**—Peru has sharply reduced turtle harvests since 1987, but small harvest are still reported.*

plummeted to a mere 700 t in 1995 (appendix E5c).

Billfish: The domestic Peruvian billfish catch is negligible (appendix B5b). One sport fishermen in the early 1950s, however, reported an abundance of black marlin off Cabo Blanco, especially in what he referred to as "black marlin boulevard" from 2-6 km offshore, never more than 8 kilometers. Striped marlin were somewhat further offshore, 5-13 kilometers.[411] Foreign longline fishermen are taking billfish off Peru. FAO assessments suggest that stripped marlin are particularly plentiful in the waters off southern Peru and stripped and blue marlin off extreme northern Peru and Ecuador.[412] There is an area off the northcentral coast where billfish are not abundant, the same area where swordfish abundance is the lowest. Government officials believe that the potential billfish catch is especially significant.[413] The fish are generally beyond the range of artisanal fishermen, but they appear to come in closer to the coast when oceanic water temperatures rise. One Peruvian company initiating longline operations reports that marlin and sailfish in particular are abundant in 1997 because of the abnormally warm water.[414] IMARPE confirms the appearance of marlins in coastal waters.[415] Artisanal, commercial, and recreational fishermen are reportedly taking both swordfish and marlin since the water began warming in 1997 (photos 26-27). The Japanese vessels working with Peruvian companies appear to be reporting billfish and swordfish catches of 4-5 percent (appendix B5a and figure 25).[416]

Sea turtles: Four species of sea turtles occur off Peru. Green (*Chelonia mydas*) and leatherback (*Dermochelys coriacea*) turtles are the most common. Hawksbill (*Eretmochelys imbricata*) and olive Ridley (*Lepidochelys olivacea*) also occur (appendix H). Loggerheads (*Caretta caertta*) are observed rarely. Virtually no Peruvian research is available on these species, let alone on the by-catch of the fishing industry. Foreign researchers have done some work, including satellite monitoring.[417] MIPE has prohibited the taking of leatherback and small green turtles (80 cm or smaller).[418] The other species were not protected and were still unprotected as of 1989. Some observers report that regulations protecting greens and leatherback are rarely observed. Peru conducted directed commercial turtle harvests throughout the 1980s. The directed fishery for turtles centered on San Andrés in Pisco Province south of Lima (13°S).[419] As recently as 1990 over 100 t of turtles were harvested (appendix B5f and figure 29), although catches have since declined to negligible levels. The authors have no information on Peruvian by-catches. One Chilean company operating longliners in the Eastern Pacific reports that while they do not experience turtle by-catches in Chilean waters, there are some turtles taken off Peru, mostly leatherbacks.[420] Given the limited Peruvian commercial longline effort, turtle by-catches would appear limited. No information is available on the foreign turtle by-catch off Peru. Available reports are

***Photo 55.**--Turtles nesting on Mexican and Costa Rican beaches, like this olive Ridley at la Escobilla in Oaxaca, have been taken as far south as Peru and Chile. Rolland Schmitten*

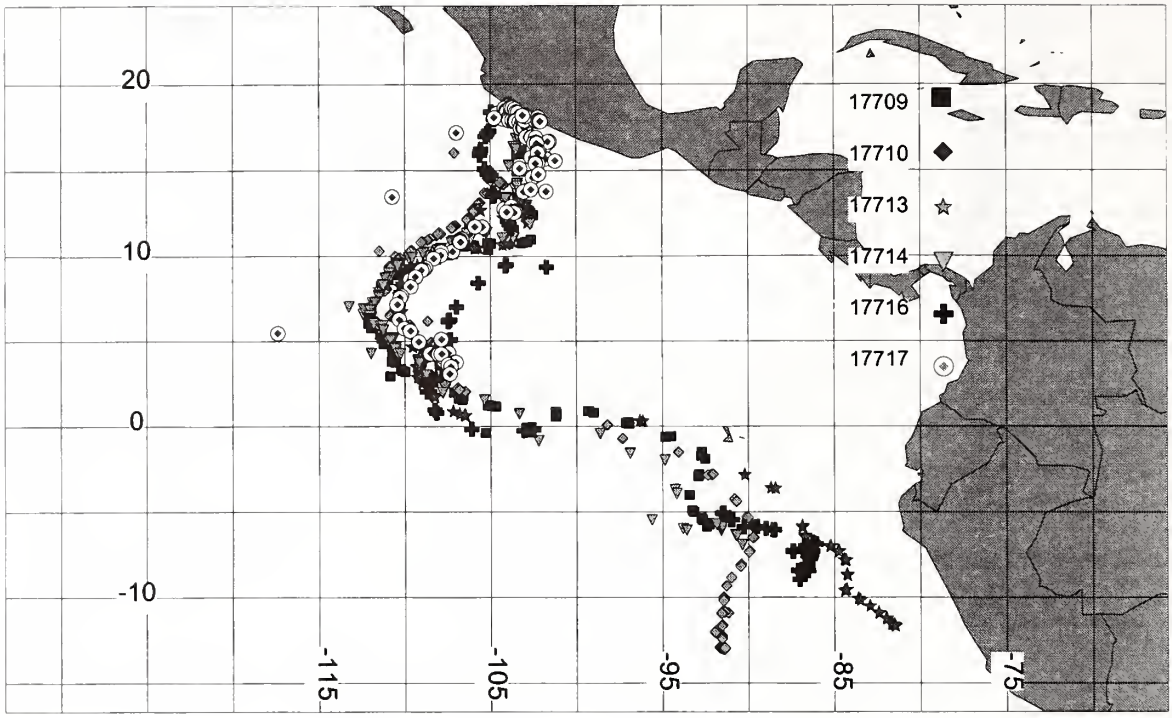


Figure 30.--Over a 6-month period, leatherbacks tagged at Mexiquillo Beach (Mexico) moved south to the Galápagos Islands and then appear to be head south/southeast toward Peru and Chile. Scott Eckert

somewhat contradictory. One study suggests that foreign longline fishermen in the western Pacific seldom or rarely take turtles and do not retain them.[421] Ecuadorean officials, however, report seizing turtle skins aboard Japanese longliners.[422] U.S. longline fishermen operating off Hawaii do report turtle interactions. Fishermen report hook rates of 0.12-1.15 turtles per 100,000 hooks.[423] Environmentalists are especially concerned about leatherbacks as populations have plummeted in recent years. Mexican officials report that leatherback nestings have reached critically low levels.[424] Anecdotal accounts and tag returns have noted incidental catches of leatherbacks from Mexican and Costa Rican beaches in the southeastern Pacific as far south as Chile. Recent satellite tagging data shows that after nesting at Mexican beaches, leatherbacks move due south through oceanic areas off Central America to the Galápagos. The turtles then appear to be moving on to Peru and Chile, although only preliminary data is available (figure 30).[425] Interactions off Peru may be limited because of the still minor longline fishery and relatively small inshore driftnet fishery. The shark longline fishery and the developing longline fishery may take small numbers of leatherbacks.

Pinnipeds: Peru has a population of both fur seals (*Otaria flavescens*) and sea lions (*Arctoceplalus australis*).[426] Both species are protected under Peruvian law, but enforcement is not a high priority.[427] Fur seals and sea lions have overlapping ranges. Fur seals occur along the central and southern coast, from Mazorca Island (11°S) south to Punta Coles (17°S). The population is especially concentrated in the area from 13-15°S. Sea lions occur along most of the coast, from Isla Foca (5°S) south to Morro Sama (18°S) near the Chilean border. There are particularly dense populations at several points along the coast, but primarily along the central coast. The largest sea lion populations are reported at El Dorado (9°S), an area along the central coast (13°S), and Chincha Sur, Ballestas, and Morro Quemado Islands (14°S).[428] The central coast is not an area where longline fishermen have focused, but no information is available on oceanic and seasonal distribution or interactions with longline and other fisheries. Such interactions are not believed to be common, but there are reports of some incidental catches in other areas (photo 47).[429] The lack of a significant commercial longline fishery in Peru means that there is currently no seal and sea lion by-catch associated with a swordfish fishery. Significant incidents, however, are reported with artisanal

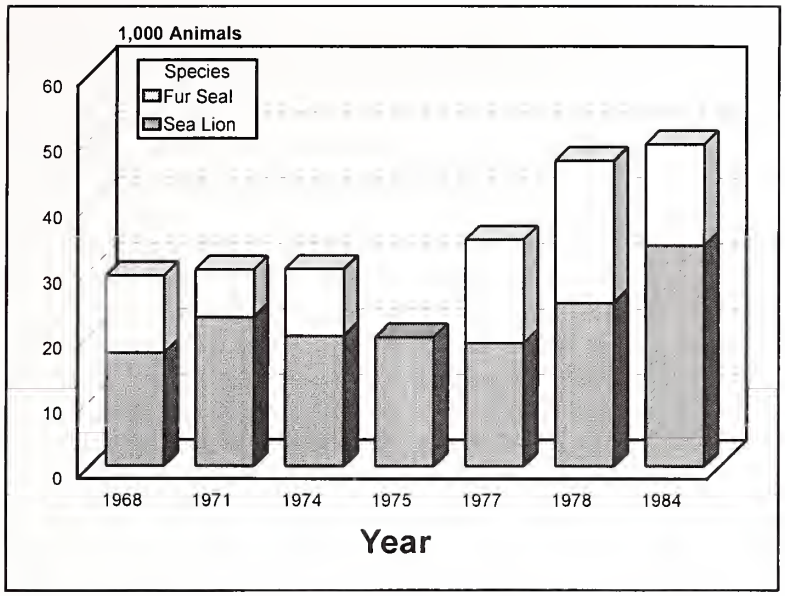


Figure 31--Peru reports expanding pinniped populations, although no recent surveys are available

fishermen. One observer estimates that as much as 25 percent of the overall artisanal catch is lost to the sea lions and fur seals. Damage to fishing gear is an especially serious problem for low-income fishermen who often are able to eke out only a marginal existence.[430] The artisanal fishermen have in recent years been complaining of increasing problems with pinnipeds, especially sea lions.[431] Virtually no information is available on foreign interactions, but based on an assessment of western Pacific fisheries, interactions may be rare.[432] U.S. longline fishermen in Hawaii do not report pinniped mortalities, but local populations are quite small.[433] Current Peruvian pinniped population data is old. IMARPE conducted the last census in 1984.[434] One unconfirmed estimate, however, suggests that pinniped populations appear to have increased significantly in recent years (appendix B5g and figure 31). MIPE has created a commission to study this problem. IMARPE reportedly initiated a census in March 1997. The commission is reportedly considering a trial cull of 1,000-2,000 sea lions, but environmental groups object.[435]

Cetaceans: The authors have no information on small cetacean by catches off Peru. Information available for the western Pacific suggests cetacean interactions with longlines are unusual, although occasional dolphin by-catches have been reported.[436] It appears that the primary problem with cetaceans is that the animals learn to feed on the longline by-catch. This is a serious problem reported elsewhere in Latin America.[437] Some incidental hookings or tangles are possible with the animals playing or feeding on the bait or hooked catch. Such interactions are probably limited as given the cost to the fishermen, they will usually avoid areas in which cetaceans, especially killer whales and false killer wales, are found.[438] The domestic Peruvian fishermen because of their limited longline effort would have very few such interactions, although the more extensive foreign effort may be taking a few cetaceans. U.S. Hawaii-based longline fishermen report extensive interactions with cetaceans, but few mortalities.[439]

B. Other fisheries

IMARPE reports that swordfish have been taken by factory trawlers. Peru during the 1970-80s signed contracts with the Soviets and other distant-water fishing countries permitting access to Peruvian waters.[440] IMARPE reports that these vessels during the 1980s reported significant swordfish by-catches (appendix B3c2). Such by-catches are unusual, but the authors have been unable to obtain details on the fishery. The amounts involved, in 1984 nearly 300 t, were much larger than the small domestic catch. The authors have been unable to obtain any details on the fishery involved, but the vessels involved were probably Soviet. It is unclear, for example, whether it was by-catch from factory trawlers conducting mid-water trawls for jack mackerel or demersal trawls for hake.[441] Much of the hake trawling was conducted off the northern coast around Paita, the same area that the traditional Peruvian swordfish fishery was conducted. By-catch from factory trawlers were also reported in 1993, about 55 t (appendix B3d2).

XVI. International

A. International relations

1. Bilateral

Peru is actively engaged on a variety of international fishery issues. Peruvian officials have been involved in fishery discussions with both neighboring and distant-water countries, although the distant-water contacts have primarily been with foreign fishing companies. Highly migratory fish, in particular, create a variety of concerns with neighboring Chile as well as several distant-water fishing countries.

Neighboring countries: Peru's most important bilateral relationship is with neighboring Chile. They share important transboundary pelagic stocks that are critical to their respective fishing industries. The two countries have made little progress, however, in cooperating on fishery issues. Swordfish does not appear to be a subject under consideration in the limited meetings between the two countries. It is still a species of minor importance in Peru. Peruvian officials have to date shown little interest in pursuing significant cooperative efforts on major species, such as anchovy, let alone on a species which is not currently of major concern.

Distant-water companies: Several distant-water fishing countries are currently active in the southeast Pacific (Latin America, appendix C2b). Peru has generally restricted access to its coastal waters. The Government during the 1970s and 1980s licensed foreign tuna fishermen, but with a few exceptions (primarily Cuba and the Soviet Union) restricted most other foreign fishermen.[442] More recently licenses have also been issued to Japanese and Korean squid fishermen. Most of the current longline effort is deployed by the Japanese and to a lesser extent the Spanish. The foreign tuna fishermen report a small incidental swordfish catch. Most of the Japanese effort is beyond Peru's 200-mile zone and transshipped at sea. One Peruvian source stressed that there are no Japanese transshipments.[443] The relatively few Japanese vessels that have obtained licenses for operations within the 200-mile zone, worked in association with Peruvian companies and landed their catch in Peru. In addition, the Japanese use the Peruvian ports to obtain supplies and to recruit local crews. Spanish fishermen are also operating in the southeast Pacific, although to a lesser extent. The Spanish do transship their catch through Peruvian ports. (See: "Transshipping.") Unlike the Japanese, the Spanish target swordfish. Peruvian fishermen insist that a large fleet of longliners (mostly Japanese and Korean, although some Taiwanese as well) of about 100 vessels fish off Peru's 200-mile EEZ. They have preferred not to pay Peruvian fishing fees and instead have operated outside the country's waters.[444] The authors have been unable to confirm this level of foreign activity, but available catch data suggests that the number of foreign longliners operating in the southeastern Pacific (FAO area 87) is substantial, but not massive (appendix A2b). The Japanese catch reported in 1993, for example, could have been taken by about 60 longliners.[445]

Details on Peruvian fishery relations with specific countries include the following:

Chile: Chile and Peru confront a wide range of unresolved fishery issues. The similarity of oceanographic conditions off northern Chile and southern Peru means that there are many transboundary stocks. Fishermen from the two countries generally target the same species and stocks along their common marine boundary. The swordfish appearing off Peru seems to be a shared stock with Chile. (See: Species: Stock structure.") The two countries, however, are making no progress in cooperatively managing their shared marine resources. Peru and Chile have a heavily militarized border and considerable tension existing between the two governments have, until recently, prevented cooperation in many seemingly beneficial areas. Sharply different philosophical outlooks during the 1970s and 80s aggravated historic problems between the two countries. Since the return of a democratic government in Chile during 1990, tensions have cooled. There have been some preliminary contacts between fishery officials on major stocks, but little progress has been made in cooperating on management. Officials discussed the possible coordinated management of the anchovy stock off southern Peru and northern Chile in 1994. These discussions, however, did not result in any coordinated effort. The Chileans restricted fishing in their zone during 1994, but the Peruvians did not reciprocate. No further meetings have been held. Officials focused on some of the more important stocks, such as anchovy, and have not yet even begun to discuss arrangements on other smaller fisheries such as swordfish. The two countries appear to have different interests at stake regarding swordfish--complicating possible future cooperation. Chile has developed a commercial swordfish fishery and a regulatory regime and is interested in restricting foreign fishing in the southeastern Pacific to protect its domestic fishermen.[446] Chilean officials are very concerned about their plummeting catch, would reportedly like the Peruvians to help curtail Spanish

and other distant-water fishing on swordfish. Peru, on the other hand, has no current directed swordfish fishery or significant incidental landings and has not implemented regulations specifically covering the swordfish fishery. This includes regulations on the fishing methods employed by the foreign distant-water fishermen or the quantity harvested. As their fishermen do not currently target swordfish, they have little to lose from foreign fishing. Peruvian reluctance to limit foreign fishing in the southeastern Pacific is perhaps due to the significant financial inducements in attracting foreign vessels to Peruvian ports. Peruvian fishery officials do not seem to object to the foreign distant-water activity in the ETP as long as the foreign fishermen do not fish in Peruvian waters.

Ecuador: Peruvian fishery relations with neighboring Ecuador are of less importance than with Chile. There are very significant climatic and oceanographic differences between most of the Peruvian coast and the Ecuadorean coast. The major species targeted by Peruvian fishermen are of much less significance to the Ecuadoreans. While there are some shared stocks, significant differences exist between the species targeted by the fishermen of the two countries. Ecuadorean fishermen have made considerable progress in developing a longline fishery.[447] As the Peruvian fishermen are only beginning to develop their own longline fishery, Peruvian officials have not yet felt it necessary to pursue discussions on possible cooperation with Ecuadorean officials. The authors note, however, that the historical Peruvian swordfish fishery was along the northern coast close to the Ecuadorean border. Thus as the two countries develop a longline fishery for swordfish, there may be some conflict. Longline fishermen from the two countries appear to be targeting different areas. The authors note that recent Ecuadorean efforts to target swordfish have not been off its southern coasts, but rather waters to the west of the Galápagos.[448] The Peruvian company (Sindicato Pesquero) launching a directed swordfish fishery in 1997, however, is planning to extensively fish along the northern coast near the Ecuadorean boundary. (See: "Companies.")

Japan: Peru has limited contacts with Japanese Government officials over highly migratory species, but does have extensive contacts with private Japanese associations representing the distant-water fishermen. The Japanese operate widely in the southeastern Pacific (FAO area 87).[449] The Japanese reportedly purchased significant numbers of licenses during the 1970s and early 1980s; in some years a total of more than 100 licenses were issued.[450] One Japanese press report in 1988 indicated that about 100 Japanese vessels were operating off Peru, but it is unclear if they were purchasing Peruvian licenses.[451] The Japanese primarily target tunas, but also take important quantities of swordfish and billfish.[452] The Japanese have reported swordfish catches ranging from 250 t (1989) to 1,000 t (1992) (Latin America, appendix C2b). One unconfirmed report in 1988 indicated that a fleet of about 50 Japanese longliners were operating outside of the Peruvian 200-mile EEZ. A Japanese fisheries delegation from the Japan Tuna Fishing Association visited Lima in August 1988 to discuss access to the EEZ. Japanese officials offered to donate equipment, but the talks reportedly failed. The Instituto Peruano de Derecho Pesquero advised against the Japanese proposal.[453] One unconfirmed report suggested that a Peruvian participant demanded donations for the APRISTA party. One report suggested that in 1989 the Japanese vessels generated about $100 million in business in Callao, involving refueling, repairs, supplies, and local crew members.[454] The Peruvian Government has also issued licenses permitting some longlining operations within the Peruvian 200-mile EEZ. (See: "Government Agency and Policy.") The regulations governing these operations have changed substantially from year to year. The number of vessels purchasing licenses has declined significantly. Only a few Japanese vessels purchased licenses in the early 1990s (appendix G3). The decline appears to be primarily due to the escalating costs involved. (See: "Government Agency and Policy.") Peruvian Government sources provide varying estimates as to the number of licenses granted, but all report relatively small numbers (appendix G1-3).[455]

Korea: Korean distant-water fishermen also operate in the southeastern Pacific (FAO area 87), but the last reported swordfish catches were 1981 and 1991 and the quantities were very small (Latin America, appendix C2b). There would seem to be a swordfish by-catch associated with their operations, although no such catch is being reported to FAO. The fishermen report operations primarily outside of the Peruvian 200-mile zone. The Korean tuna fleet in recent years have not purchased for access to the Peruvian 200-mile EEZ (appendix G3). Overall Korean tuna longline yields off Peru are highly variable: no activity in 1988, moderate yields outside of the EEZ in 1989, excellent yields outside the EEZ in 1990, and moderate yields off the southern coast and goods yields beyond the EEZ during 1991 and 1992.[456] One unconfirmed report suggests that Korean tuna longliners operate out of Peruvian ports.[457]

Spain: Spanish sources confirm that their fishermen are fishing for swordfish and tunas in the southeastern Pacific, outside of the 200-mile zone of the coastal countries.[458] The Spanish are reportedly targeting fish 320-800 km off the coast, which is the same stock the Chilean longliners are targeting. Most of the Spanish fishing appears to be off southern Peru

and northern and central Chile as far south as 35°S, but some operations are reported as far north as Ecuador.[459] The best swordfish grounds appear to be located off Chile. Companies working with the Spanish as well Chilean Navy data all confirm operations as far south as central Chile.[460] Given the desire of the Spanish to use Chilean ports, it is likely that latitudes off Chile are their primary fishing grounds. The Spanish longliners began fishing in the Pacific during early 1989. The first transshipments were reported in mid-1989.[461] The Spanish fishermen, however, are not reporting their swordfish catches to FAO (Latin America, appendix C2b). Details on the level of activity in the early 1990s is unavailable, but a relatively modest number of Spanish vessels appear to be operating in the Pacific. The authors do not have a complete list of the vessels involved, but believe the 11 longliners known to have been deployed in 1996-97 constitute most of the Spanish effort (appendix A2). One of the most active companies is Pesquera Maicoa based in Vigo. The company has deployed three longliners (*Maicoa*, *Maicoa I*, and *Urugora*) in the eastern Pacific during 1995-96 (appendix A2).[462] Another Vigo company, Palangeros del Atlántico, deployed the *Arosa Primera*.[463] While other deployed a longliner (*Alicante*) in 1996. Other Spanish longliners (Rosu III) were also active in 1997. The authors know of 11 Spanish vessels active during 1996-97 (appendix A2). The Spanish primarily operate out of the southern port of Ilo, but some of the catch is also transshipped through Pisco and Callao.[464] (See: "Transshipments.") The use of Peruvian ports appears to be the only viable option open to the Spanish. The Chileans do not permit foreign swordfish fishermen to use Chilean ports for transshipping.[465] The Spanish report that their inability to transship through Chilean ports severely restricts their operations as some of the best fishing grounds are off Chile. The Spanish are reporting better catch rates in the Pacific than the Atlantic, but lack of access to Chilean ports significantly increases costs and thus has limited the expansion of the Spanish fishery into the Pacific.[466] The Spanish primarily use Ilo because it is the closest available port to their major fishing grounds. A recent report indicated that one of the vessels, the *Maicoa* transshipped product in Ilo on June 14, 1996.[467] The Spanish are not purchasing Peruvian licenses which would allow them to operate within the Peruvian 200-mile EEZ (appendix G3), presumably because the potential benefits from access do not justify the cost. One report indicates that the Spanish normally transship 120-150 t per vessel, although this varies widely because of the different size vessels deployed.[468] One observer reports that the Spanish are taking large quantities of juvenile swordfish and landing them in Peru.[469] Spanish fishermen, however, deny this.[470] (See: "Transshipments.") The authors have no official data confirming the sizes being harvested.[471]

Taiwan: Taiwan fishermen report no swordfish catches in the southeastern Pacific (FAO area 87), the FAO area off Peru. Taiwan does, however, report a sizeable swordfish catch to the north in FAO area 77. This FAO area, however, extends far out into the central Pacific and is not restricted primarily to coastal waters. The Taiwan swordfish catch is taken more in the central Pacific than off Central America. Detailed Taiwan 1992 data, the most recent year available to the authors, show no Taiwan longline catches east of 110°W.[472]

United States: United States swordfish longliners in the Pacific primarily operate north of the Hawaiian Islands, although a few also operate out of southern California.[473] Operations in the South Pacific for swordfish are unusual, although there is some activity for albacore in the western Pacific.[474] One U.S. fishermen is known to have longlined swordfish and tuna in the southeastern Pacific outside Chilean waters during 1991-92 which he transhipped through Peru because of Chilean restrictions on transshipping swordfish.[475]

USSR: Soviet distant-water fisheries at times reported substantial catches of swordfish, usually in the south Atlantic off West Africa (appendix B6).[476] The Soviets have not reported any incidental swordfish by-catch in the Pacific to FAO, despite conducting a major mid-water trawl fishery off Chile and Peru until the early 1990s.[477] Limited Soviet trawl fishing for demersal fishing was at times conducted within Peru's 200-mile zone. IMARPE reports, for example, that during 1983-85 the Soviet vessels fishing within Peru's 200-mile zone took as much as 318 t of swordfish (1984). The authors have been unable to find any description of this fishery. The by-catch appears to have been largely incidental catches. It could be that the catch was taken incidentally to a demersal trawling operation off northern Peru.[478] This would explain the absence of any swordfish by-catch reported in the large Soviet mid-water trawl fishery off Peru and Chile outside the 200-mile limit (Latin America, appendix C2b). But this cannot be confirmed as the accuracy of Soviet reporting is unknown.

2. Multilateral

Swordfish in the southeastern Pacific has received only limited attention from multilateral organizations. Several organizations involved with tuna have shown some interest in the western Pacific (Indian Ocean Fisheries Commission, Indo-Pacific Fisheries Commission, South Pacific Commission, South Pacific Forum Fisheries Agency, and others), but work on the southeastern Pacific has been more limited. In part this is due to the small number of coastal countries involved. Colombia, Ecuador, Peru and Chile are the only southeastern Pacific (FAO area 87) coastal countries and only Chile has an active swordfish fishery, although some developments have been reported in Ecuador during 1996-97. In addition there are only a small number of distant-water countries actively taking swordfish (Japan and Spain). The primary multilateral groups are:

Eastern Pacific Ocean Tuna Organization (EPOTO): This organization was created in 1995 as a result of a long series of negotiations sponsored by the Organización Latinoamericana de Desarrollo Pesquero (OLDEPESCA). Peru was an active participant in these negotiations. EPOTO is not yet active and, if and when it begins work, will almost certainly focus on tuna. Swordfish would likely be a low priority, if addressed at all.

International Symposium: Researchers from various countries are expanding work on swordfish, in part because of the increasing fishing pressure and concern over stocks. Most researchers believe that given the highly migratory nature of the fish, a full understanding of the stock structure will require a cooperative international research effort. The first international symposium on Pacific swordfish was held in Ensenada, Mexico during 1994. A second symposium was held in Hawaii during 1997. Peruvian scientists have not participated.

Inter-American Tropical Tuna Commission (IATTC): The IATTC was formed in the 1950s to manage ETP tuna resources. The organization has focused on tunas, especially yellowfin, which occurs primarily in tropical waters. Peru is on the southern limit of ETP yellowfin concentrations, although in some years extremely good fishing has been reported off Peru. Peru is not a member of IATTC, but the country has at times attempted unsuccessfully to enter the ETP tuna fishery.[479] IATTC has two primary programs. One is the Tuna-Dolphin Program and the other is the Tuna-Billfish Program. While the IATTC's primary focus has been on tunas, important work has also been done on swordfish and billfish.[480]

Peru was active in the negotiations of the international convention on straddling fish stocks and highly migratory species conducted during 1994 and 1995. A convention was finally adopted by a U.N. conference on August 4, 1995. Some Peruvian industry representatives were critical of the treaty, believing erroneously that it requires coastal countries to grant access to foreign fishermen. José Sarmiento, President of the Sociedad Nacional de Pesca, was particularly concerned about possible access by EU countries.[481] As of July 1997, Peru has not signed the treaty.

B. Joint ventures/commercial activities

No joint-venture fishing companies are currently active in Peru targeting tunas and swordfish. Japanese companies have, however, been involved in several unsuccessful joint ventures to launch fisheries for oceanic pelagics. Japanese companies were involved in the failed Tuna Latin and Consorcio Pesquero projects. They also currently conduct a variety of commercial activities associated with their distant-water fishing operations in the southeastern Pacific. Foreign investors have been hesitant to make long-term investments in Peru given the experiences of other foreign investors during the 1970s and 80s. Efforts by a variety of countries (including Cuba, Japan, Poland, the United States, and the USSR) have resulted in contentious, often acrimonious political debates and protracted legal disputes.[482] Even as recently as 1993 such problems have been reported. A Peruvian company (Cultecmar) attempted to operate 11 small trawlers obtained through a joint venture association with a Russian company. MIPE insisted on a fee for a 6-months permit. CULTECMAR insisted that the General Fisheries Law of 1992 authorized such imports and that the fees assessed were excessive for small vessels. Company representatives maintain that the fees assessed were appropriate for the large stern factory trawlers deployed by previous joint ventures, but not the small trawlers the company wanted to deploy.[483]

Some information is available on tuna joint ventures:

Japan: There were two unsuccessful Japanese tuna/swordfish longlining joint ventures in Peru during the early 1990s. These efforts have proven very controversial.[484] Tuna-Latin tried unsuccessfully to lease longliners, but there was apparently no equity participation by the Japanese. Efforts with Tuna Latin continued through 1994 when at least one Japanese longliner (*Taisei Maru I*) worked with the company. Press reports indicate that in 1995 the Inter-American Investment Corporation and the Japanese International

Development Organization agreed to help finance a $6.2 tuna export operation with Consorcio Pesquero. (See: "Companies.") Plans called for producing and exporting frozen sashimi-quality tuna and shark fins.[485] Although not identified in the report, presumably swordfish and other billfish were also involved, but they would be of lesser importance because of the lower prices they command on the Japanese market.[486] The project, however, proved unsuccessful and PPP, the parent company of Consorcio Pesquero, has closed the operation and the longliners involved are sold or idled. There also appears to be an arrangement with Pesquera Atlantis in 1996-97, although it is unknown if there is any japanese equity participation. The Japanese also conduct a variety of commercial activities in Peru associated with the operations of their longline vessels in the southeastern Pacific. The primary target species are tunas, but some swordfish and other billfish are also taken incidentally. The Japanese Federation of Tuna Cooperatives (Nikkatsuren) established the joint venture Servicios Ejecutivos Comerciales (SEC) in Callao during 1987. The Japanese partner was Japan Tuna (Panama) and the Peruvian partner was M. Woll. Peruvian fishery specialists criticized the ventures being considered.[487] The Nikkatsuren then established Servinave in Callao during 1989 to recruit Peruvian fishermen to work on Japanese tuna vessels. Finally, Nikkatsuren established Japan Tuna del Peru during 1993 to provide ship agency services to member vessels working with SEC.[488] The Japanese Government is apparently trying to promote a joint-venture company. Japan has over the years provided some fisheries assistance. (See: "Foreign Aid.")

Panama: One Panamanian-flag tuna longliner reportedly operated in association with Consorcio Pesquero during 1995-96. The longliner is presumably a flag-of-convenience vessel owned by a Japanese company. This appears to have been a leasing arrangement with no Panamanian equity participation.

Spain: The authors know of no Spanish-Peruvian joint fishing ventures. The Spanish companies operating longliners in the Pacific appear to be very small operations with at the most three or four vessels.[489] None appear to have made contractual relations with Peruvian fishing companies.

United States: U.S. fishing companies, primarily U.S. tuna companies, were involved in the development of the Peruvian swordfish fishery during the late 1940s and early 1950s.[490] The authors, however, have no details on the contractual relations. A US tuna company operated a cannery in Peru during the 1960s-70s until it was nationalized in 1973. A US company recently participated in a 1-year longlining venture in 1994-95 with the UNP, but the venture was not renewed. (See: "Research.") There are no U.S. longliners operating off Peru.

C. Foreign Aid

Various countries and international organizations have provided fisheries assistance to Peru. The most significant donor country during the 1970s was the Soviet Union, but the Japanese have also provided important assistance. The Japanese have funded small projects since the 1960s. A Japanese/Inter-American Development Bank (IDB) project in 1995 focused on longlining for oceanic pelagics. The project targeted primarily tunas and sharks, but there was a small swordfish by-catch. The project proved unsuccessful and was closed in 1996.

1. Bilateral

the Japanese have been the country most involved in Peru's longline fishery, but other countries have provide fisheries assistance.

Japan: The Japanese have provided extensive fisheries assistance for many years, working with Peru's principal fisheries research institute, the Instituto de Tecnología Pesquero, which focuses on fishing gear and seafood processing technology. They also assisted the fisheries training school in Paita. The Japanese are currently working with university groups assisting Peru to develop longline fisheries which could eventually enable fishermen to target Peru's offshore tuna and swordfish resources. (See: "Research.") The Japan International Development Organization and the Inter-American Investment Corporation signed an agreement in 1995 to jointly finance a $6.2 million project in Peru to export sashimi-grade tuna and other oceanic pelagics.[491] The project, however failed and ended in 1996.

United States: During the late 1940s and early 1950s, U.S. freezer vessels were contracted by Peruvian companies to freeze the catch of artisanal fishermen. The operation enabled the fishermen to land substantial quantities of swordfish. (See "Catch".) U.S. baitboats (1940s-50s) and purse seiners (1960s-70s) also operated off Peru, but given the methods used there was only a negligible swordfish by-catch. In recent years only one U.S. fishermen has obtained a fishing license. The U.S. tuna seiner *Connie Jean* was licensed in 1995 (appendix G2).

USSR: The Soviets provided substantial assistance during the 1970s, including some well-publicized large projects.[492] There is considerable differences of opinion, however, among Peruvians concerning the impact of the Soviet assistance.[493] One major accomplishment was assistance in building the Paita

fishing port in northern Peru. (See "Ports.") Much of the Soviet assistance was oriented toward demersal fisheries. The authors know of no project involving swordfish. The Soviet assistance coincided with a substantial deployment of their fishing vessels to the southeastern Pacific[494]

2. Multilateral

The primary multilateral organization involved in Peruvian fisheries has been the IDB.

FAO: FAO has for years worked with MIPE. FAO work on stock assessment, funded by Norway, has been particularly valuable. As with virtually all joint ventures and fishery development projects in Peru, the FAO effort has not been without controversy.[495] FAO experts have provided technical assistance with a series of fishery development plans.[496] FAO experts have recently been involved in MIPE efforts during the mid-1990s to formulate a comprehensive fisheries management program. (See "Industry Overview".) The authors know of no FAO activity associated with the longline fishery.

IDB: Inter-American Development Bank (IDB) also has a long history of involvement in Peru.[497] One recent project concerns longlining and oceanic pelagics. The IDB Multilateral Investment Fund announced on March 21, 1996, the approval of $3 million in non-reimbursable financing for a 2-year project (ATN/MH-5172-PE) for tunas, sharks, rays, and "quimera" (English equivalent unknown). Swordfish is included only as an incidental species. IDB officials report that they also seek to modernize fisheries training and to strengthen the Government's capability to implement a resource management system for oceanic pelagics.[498] A pilot program in fish handling and processing will also be carried out. The project includes: longline training, handling and processing of fresh fish for the sustainable export of the selected pelagic species.[499] Trainees will receive hands-on instruction in fishing techniques aboard modern longline vessels. Peruvian scientists and technicians will undergo training in fisheries management. The Universidad de Piura (UDEP) is coordinating the project, the Consorcio Pesquero, and the Institute of Fisheries Technology (ITP) are participating as well as the Universidad Nacional de Piura (UNP).[500] UDEP officials indicate that in mid-1997 they were beginning the implementation phase.[501]

World Bank: The World Bank has assisted Peru with the costs of privatizing the extensive array of state-owned companies. The Bank approved a structural adjustment loan in 1991, but advised the Government not to proceed with the privatization of PESCA-PERU until a regulatory framework was implemented to manage the fishing industry for sustainable development. Since then there has been considerable disagreement between Peruvian and Bank officials. The concerns primarily involve management of the large anchovy reduction fishery producing fishmeal. Peruvian efforts have been particularly critical of some of the suggestions on fisheries management made by Bank technical advisers. (See "Industry Overview.") The authors know of no Bank activity associated with the longline fishery.

XVII. Enforcement

Peruvian fishery officials report extensive incidents with foreign fishermen. Officials seized several foreign tuna vessels during the 1960s and 1970s. Most of these incidents were tuna purse seiners (Mexico, the United States, and Spain). Several other countries (Cuba, Poland, and the USSR) have also been active off Peru and involved in highly publicized incidents, but these incidents were with companies deploying trawlers.[502] Since the early 1980s, the number of fishery incidents have been very limited, primarily because of the withdrawal of the U.S. fleet from the ETP. Incidents now mostly involve the seizures of small Ecuadorean vessels. The principal country operating longliners off Peru is Japan, although Spain and Korea also operates a few. Interestingly, despite the level of Japanese activity the authors have noted no seizures. Industry sources contend that the number of foreign tuna longliners (mostly Japanese) operating off Peru outside the 200-mile limit in the southeastern Pacific (FAO area 87) is very significant, some estimates are as high as 200 vessels.[503] The authors, however, cannot confirm this estimate. The absence of Peruvian seizures suggests that industry sources may have an exaggerated opinion concerning the level of offshore fishing activity.[504] Based upon the quantity of tuna and swordfish being landed, the number appears much less than 100 vessels.[505]

Available details concerning enforcement activities are as follows:

Chile: There have been a few fishery incidents reported along Peru's southern coast involving Chilean and Peruvian fishermen.[506] Such incidents are infrequent, but some have involved the exchange of fire.[507] The number of incidents has been limited, presumably because the Chilean companies operating vessels along the northern coast are relatively large fishmeal companies keeping close control over the operations of their seiners. The authors know of no seizures of Chilean longliners.

Ecuador: Peru's major enforcement problem is off its northern border with Ecuador. The press in both countries regularly reports incidents involving small Ecuadorean and Peruvian fishing boats.[508] The vessels involved are usually small artisanal craft, as well as shrimp trawlers and seiners. The fines assessed are usually modest, but some Ecuadorean tuna seiners have been assessed significant fines.[509] In some instances navy patrol vessels have fired on the fishing vessels and individuals have been killed.[510] These incidents have recently become even more potentially serious because of the military border confrontation between the two countries in 1995. Rumors have been reported, apparently erroneously, of naval deployments.[511] The authors know of no Peruvian seizures of Ecuadorean longliners. The Ecuadorean longline operations are conducted primarily from Manta and other ports well north of the marine boundary with Peru.

Japan: Despite the numbers of Japanese longliners operating off Peru, the authors have not noted extensive press reporting on seizures for fishery infractions. One Peruvian source, however, claims that, since the late 1960s, a large number of Japanese longliners have been seized by Peruvian authorities.[512] The authors have unable to confirm such seizures. The only press report noted by the authors of a seizure involved a non-fisheries incident. The Japanese longliner *Kiowa Maru No. 8* struck and sunk the Peruvian submarine *Pacocha* near Callao on August 26, 1988.[513] The Peruvian Government seized the Japanese vessel and a Peruvian court held the Japanese captain responsible for the incident. The owner was fined $53 million. The captain was sentenced to 2 years in prison and the pilot and navigator to 1 year each. The owner asked that the fine be reduced to the $2 million repair costs. The Peruvian Government noted that the fine included payments of 20 million intis for each of the eight Peruvian sailors killed and 5 million intis for the wounded sailors.[514]

Korea: The authors have noted no seizures of Korean vessels.

Mexico: Since Mexico has developed an important tuna fleet capable of distant-water operations, there have been a few Peruvian seizures of Mexican vessels.[515] All of the vessels involved are tuna purse seiners, the only Mexican fishing vessels capable of distant-water operations.

Taiwan: The authors have noted no seizures of Taiwan vessels.

United States: Peru seized several U.S. tuna seiners in the 1960s and 1970s. These incidents declined in the 1980s as the U.S. fleet gradually withdrew from the ETP and declined in size. One incident was reported in 1995 when the U.S. seiner *Connie Jean* was briefly detained in Paita. While the vessel had a Peruvian valid license (special research license), it also had some Ecuadorean crew. The vessel was allowed to begin fishing after it replaced the Ecuadoreans with Peruvian nationals.[516] All of the fishing vessels incidents with the United States have involved tuna purse seiners. The authors know of no incidents involving longliners.

XVIII. Future Trends

Peru has been unable to successfully launch a modern commercial fishery for oceanic pelagics. The country's major focus has been on tuna purse seining, but both private and state companies have failed in a variety of projects initiated beginning in the 1970s. Efforts to launch a commercial tuna/swordfish longline fishery have surprisingly also failed. The country has a substantial fisheries infrastructure. Peruvian companies conduct some of the largest fisheries in Latin America. The country has many well-trained fishery specialists.. Peruvian fishermen have for years been working on foreign longliners, both Spanish and Japanese. An oceanic pelagic (bonito) was the first commercial fishery in Peru. In addition, artisanal fishermen previously reported very substantial swordfish catches, albeit for a relatively few years.

Exploitable stocks of tunas and swordfish clearly exist off Peru. It is unclear if the swordfish stock has declined from the levels reported in the early 1950s. Even if it has declined, however, there is clearly no resource problem as foreign fishermen report tuna and swordfish catches on both coastal and offshore grounds. Clearly a sufficient resource of swordfish, tunas, and other oceanic pelagics exists to support a artisanal or commercial fishery. A least one commercial venture in 1997 is reporting catches of swordfish.

The reasons Peruvian fishermen have failed to develop a longline fishery for oceanic pelagic are unclear. While longlining is a minor activity, there appears to be no reason why the country's fishing industry should not be able to develop such a potentially profitable fishery. The lack of success to date may be due to a variety of factors:

Focus: Some observers believe that the massive Peruvian fishing industry may have difficulty in changing fishing strategy away from easily-caught small pelagics.

Regulations: Industry sources complain of onerous, constantly changing regulations which discourage both foreign and domestic investment.

Foreign participation: Many Peruvians are distrustful of foreign involvement in fisheries as well as other industries. Regulation of foreign companies has often resulted in onerous measures that have in effect excluded foreign participation. Such policies for a fishery in which foreign participation would be very helpful, if not essential, may be an especially important factor. experienced to date.

Import policies: Import duties on foreign-built boats make it prohibitively expensive to import longliners even though Peruvian shipyards have little experience in building such vessels.

Strategy: Peruvian efforts to develop a longline fishery have focused on operating large commercial longliners which require considerable expertise and technical support. Only recently have companies begun to deploy smaller longliners to supply high-quality fresh fish. There still is no effort to support artisanal fishermen so, as in Ecuador, they can participate in a lucrative export-oriented fishery.

Alternatives: There appear to be other alternative fisheries that do not require adopting a still relatively unfamiliar gear and method (longlining) or the acquisition of expensive vessels capable of offshore operations.

Peruvian fishermen will, in the long run, almost certainly develop a longline fishery to deliver high-quality fresh and frozen swordfish and other oceanic pelagics to lucrative foreign markets. Companies in both Chile and Ecuador have done so and there no reason why Peru will not eventually follow suit. Several factors suggest, however, that such a fishery may not develop significantly for several years. The failure of several well-publicized projects has discouraged potential foreign investors. Current policies, despite efforts in the 1990s to open the economy, have not encouraged either foreign or domestic investment in the fishery. While MIPE is currently considering changes in the regulatory regime, the precise changes are not known or how permanent they will be. Foreign companies are wary of Peru given the experience of other foreign companies. The situation is not, however, totally negative. A few companies in 1996-97 have launched modest longline projects using small coastal longliners to deliver high-quality fresh project. Foreign donors are funding modest projects aimed at diversifying the industry by promoting alternative fisheries, including the use of longlines. The results of these efforts, however, are yet to be determined

Note: This chapter was designed and formatted by Joseph Close, a senior at Frederick High School, in Maryland. Mr. Close worked with the National Marine Fisheries Service during the summer of 1997 as a part of the District of Columbia Metropolitan Consortium for Minorities in Engineering (METCOM). After finishing high school he plans to pursue a university degree in chemical engineering.

SOURCES

AFP (Paris), various broadcasts.

Ameya K., Albertina K. Director de Estudios Economicos y Evaluación de Recursos Potenciales, IMARPE, personal communications, August 14, 1997.

(The) Andean Report, May, 1989, p. 138.

Antonietti, Emira. IMARPE, personal communications, March 24, 1997.

Expreso, November 8, 1987

Aranda A., Carlos F. "Marine turtles in Peru," *Marine Turtle Newsletter*, April, 1989.

Arevalo, Alfonso and Oswaldo Hundskopf. "El Instituto Peruano de derecho pesquero dice 'No'," *Pesca*, July-August, 1988, pp. 10-11.

Bailey, Kevin, Peter G. Williams, and David Itano. "By-catch and discards in Western Pacific tuna fisheries: A review of SPC data holdings and literature," *Technical Report*, No. 34 (Oceanic Fisheries Program: Noumea, New Caledonia, 1996), p. 4.26.

Balarezo Saldaña, Sergio. Project Coordinator, IDB-UDEP Project, personal communications, July 7, 1997.

Barbieri, Maria Angela. Jefe, Departamento de Tecnología Pesquera, Instituto de Fomento Pesquero (Chile), personal communications, April 9, 1996.

Barbieri, M. A., M. Donoso, A. Gonzalez, V. Correa, B. Leiva, and A. Montiel. "Development and state of art of the swordfish fishery in Chile", paper delivered at the International Symposium on Pacific Swordfish, Ensenada, B.C., Mexico, December 11-14, 1994.

Barendiran, Javier. Commercial Department, Grupo Sotomayor, personal communications, June 11, 1997.

Bartoo, Norman W. Atilio L. Coan Jr. "An assessment of the Pacific swordfish resource," in Richard H. Strod, (ed.) *Planning the Future of Billfishes: Research and Management in the 1990s and Beyond* (National Coalition for Marine Conservation: Savannah, Georgia, 1989), pp. 137-151.

Bellolio, M., Angela Barbieri, J. Miguel Donoso Pastor, García Eleuterio Yáñez Rodríguez, Antonio González Casanga, Víctor Catasti Barraza, and Marcelo Alvarado. "Monitoreo de la pesquería de recurso pez espada (I-X Regiones, 1994)" Proyecto FIPA N°11/93 (IFOP: Valparaíso, November, 1995).

Bermejo, Alejandro. "Alan Garcia declara la guerra," *Expreso*, February 24, 1990.

_____. "Desde Parachique hasta Tumbes," *Pesca*, November-December, 1991, pp. 6-8.

_____. "En el atún, gobierno y transnacionales japonesas son 'imperialistas'," *Pesca*, July-August, 1988, pp. 12-13.

_____. "Estación naval frena desarrollo de Paita," *Pesca*, November-December, 1990, p. 5.

_____. "Necesitamos muelles," *Expreso*, November 3, 1991.

_____. "Paita, base pesquera del norte," *Pesca*, May, 1971, pp. 22-23.

_____. "Pesquero en Paita," *Pesca*, November-December, 1990, pp. 7-11.

Andean Report, various issues.

Bigelow, Keith "Influence of environmental factors on swordfish catch rates," papers delivered at the Second International Swordfish Symposium, March 4, 1997, Turtle Bay, Oahu, Hawaii.

Campos, Jorge. Manager, Consorcio Pesquero/Productos Pesqueros Peruanos, personal communications, January 25, 1996 and May 28, 1997.

Carocci, Fabio and Jacek Majkowski. *Pacific Tunas and Billfishes,* (FAO: Rome, 1996).

Chang Wong, Pedro . Gerente de Producción, Navales Industriales, Personal communications. December 13, 1995.

Chávez, Jorge Villena. "Perú: Planificación del sistema HACCP en la industria de productos pesqueros en Perú," *CC&I* (Red de Cooperación Latinoamericana de Control de Calidad e Inspeción de Productos Pesqueros: Montevideo, 1996), Vol. V, pp. 5-10.

Childers, John, and Forrest R. Miller, "Summary of the 1994 U.S. north and south Pacific albacore troll fisheries," *Southwest Fisheries Science Center Administrative Report*, LJ-95-15, July 1995, 57p.

Chirichigno F., Norma. "Nuevas especies de peces de los generos *Mustelus* (Fam. *Triakidae*), *Raja* (Fam. *Rajisae*) y *Schedophilus* (Fam. *Centroolophidae*)," *Informe*, N°42 (IMARPE: Callao, June, 1973), 40p.

Cho, Naritoshi. "An attempt to clarify genetic stock structure of swordfish using nuclear gene markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

Chong Lay-Son, Javier. Universidad Católica de Sma. Concepción. Personal communications, December 4, 1996.

Cisneros, Jaime and Enrique Sánchez. "Pesca de atún con palangre en costa norte del Perú," *Rev. Com. Perm. Pacifico Sur*, vol. 11, 1980, pp. 473-480.

Collao, Máximo. General Manager, Tuna Latin,

personal communications, June 27, 1996 and July 22 and August 4, 1997.

(El) Comercio, various issues.

Coutu, Robert. President, Ocean Fresh Seafood. Personal communications, July 11, 1996.

Covarrubias, Alejandro. Jefe de Fiscalización, Servicio Nacional de Pesca, Chile. Personal communications, July 22, 1996.

De Martini, Edward. "Sex and size composition in the Hawaiian-based longline fishery," Second International Pacific Symposium, Turtle Bay, Hawaii, March 4, 1997.

De Sylva, D.P. "Red-water blooms off northern Chile, April-May 1956, with reference to the ecology of the swordfish and striped marlin," *Pacific Science*, 1962, Vol. XVl, No. 3, pp. 271-279.

De Young, Karen. "Peruvian conservationists mounts attack on seal killers," *Washington Post*, April 3, 1978, p. A14.

Diario las Americas, various issues.

Diminich, Ivonne. Commercial Manager, Agro Pesca, personal communications, January 16, 1996.

Dollar, Robert A. "Annual report of the 1993 Western Pacific longline fishery," *Southwest Fisheries Center Administrative Report* H-94-06, August, 1994, 38 p.

Dutton, Peter. Specialist on the mollecular ecology of turtles, Comments at the United States-Mexico Fishery Cooperation Talks, Huatulco, Mexico, September 25, 1997.

Echeandía Zegarra, José. General Manager, TRAMARSA, personal communications, June 26 and July 22, 1996 and June 3 and July 3, 1997.

Eckert, Scott. Hubbs-Sea World Research Institute, personal communications, September 26, 1997.

EFE (Madrid), various broadcasts.

Espinoza Soriano, Jaime. "Tiburones de la costa peruana," *Documenta*, N°66, October-December, 1978, pp. 36-44.

Expreso, various issues.

Farrington Jr., S. Kip. *Fishing the Pacific: Offshore and On* (New York: Coward-McCann, 1953).

Federation of Japan Tuna Fisheries Co-operative Associations (Nikkatsuren). *Japan Tuna* (Nikkatsuren: Tokyo, 1995), 41p.

Fernández, Iñaki. Assistant Manager, Maicoa Fisheries, Vigo, Spain, personal communications, July 2, 1996.

Fishing News International, various issues.

Gallo, Julio Ronaldo. Ministerio de Pesqueria, Dirección Nacional de Extracción, personal communications, June 18, 1996.

Ghersi Belúnde, Ricardo. Universidad Villareal. "Lobos marinos no depredan el mar," *Informativo del MIPE*, April-June 1981.

Gonzalez, Ursino. Hotel Merlin. Personal communications, February 6, 1997.

Grechina, A. S. and D. F. Arcos. "Distribución y migración del jurel, *Trachurus symmetricus murphyi* (Nichols), en el Pacífico suroriental, *Guyana Oceanol*, Vol. 3, No. 1, 1995, pp. 3-27.

Huaylinos, Pascual. "Le soplaron aire y ... !Bluuuumm!," *Oiga*, July 31, 1989, pp. 30-33.

Humphreys, Robert. "Review of larvae and juvenile distributions with inference towards spawning habitat," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

Inter-American Development Bank New Release (NR-073/96), March 21, 1996.

INFOFISH. "Artisanal fishermen against industrial fishing," *Trade News*, December 1, 1995.

INFOPESCA. "Atun enfriado, congelado: Peru," *Noticias Comerciales*, June 20, 1995.

IMARPE. "Estadísticas de los desembarques de la pesquería marina peruana, 1983-1992," *Informe*, No. 105 (IMARPE: Callao, March, 1994), pp. 63-202.

Jacobson, Donald and Dennis Weidner. "Soviet-Latin American fishery relations, 1961-89," *International Fishery Reports* (IFR-89/39), May 5, 1989, 153p.

Justen, Mike. NMFS-F/SWR. Personal communications, October 19, 1995.

Kaczynski, Wlodzimierz. Research Associate Professor, Institute for Marine Studies, College of Ocean and Fishery Sciences, University of Washington, personal communications, July 9, 1997.

Kyodo (Tokyo), 1020 GMT, August 27, 1988.

Landa C., Antonio. "Datos sobre la pesqueria de atún aleta amarilla y barrilete en la zona económica exclusiva del Perú 1970-1977," *Rev. Com. Perm. Pacífico Sur*, vol. 11, 1980, pp. 457-472.

Levitus, Sydney and Timothy P. Boyer. "World Ocean Atlas 1994: Temperature," *NOAA Atlas NESDIS 4*, Vol. 4 (National Environmental Satellite, Data, and Information Service: Wahington, D.C., June, 1994), 117p.

Loyaza, Eduardo. Personal communications, February 13, 1996.

McDonald Checa, James. "Pesca para consumo humano directo," *El Comercio*, July 7, 1993, p. 2.

Mehía Gallegos, Jorge. "La pesca aretesanal y los lobos marinos," *Pesca*, July-August, 1989, pp. 8-10.

Meier Cornejo, Ludwig. *El Futuro de la Pesquería: Corrigiendo los Errores del Pasado* (Lima: Instituto de Estudios Pesqueros, July, 1990).

(El) Mercurio, various issues.

Ministerio de Agricultura, Pesca y Alimentación (Spain), Subdirección General de Recursos Internos Comunitarios, Dirección General de

Recursos Pesqueros. "Pesquera Española del pez espada," undated report, probably released in 1994.

Moreno, C. and A. Mendieta. "La pesqueria artesanal en la caleta de Puerto Nuevo (Paita) Julio 1986-Junio 1988," in Claudia Wosnitza-Mendo, Marco Espino, and Maria Veliz, "La pesqueria artesanal en el Peru durante junio de 1986 a junio de 1988," *Informe*, (IMARPE: Callao, 1988), pp. 22-27.

Nakano, Hideki. "Stock status of swordfish in the Pacific Ocean inferred from standardized CPUE of the Japanese longline fishery using general linear methods," in press as of March 1997.

National Fisheries Research and Development Agency (NFRDA) (Korea). "Fishery statistics and fishing grounds for the Korean tuna longline fishery, 1988-1992" *Technical Report of the NFRDA*, (NFRDA: Seoul, December 1993), 465p.

Neyra Balta, Juan. "Atún y el desarrollo del Peru," *Pesca*, January-February, 1995, pp. 11-12.

_____. "Pesquera atunera: Anhelo y desafío," *Pesca*, July-August, 1995, p. 25.

Nisikawa, Honma, Yueyanagi, and Kikawa. *Average Distribution of Larval Oceanic Species of Scombroid Fishes, 1956-81* (Far Seas Fisheries Research Laboratory: Shimizu, Japan, 1985).

Noticias Argentinas (Buenos Aires), 1931 GMT, April 22, 1990.

Olson, Don, X. Humston, and Guillermo Podesta. "Large pelagics in frontal zone environments," paper delivered at the Second International Swordfish Symposium, March 4, 1997, Turtle Bay, Oahu, Hawaii.

Orozco, R. "La pesqueria artesanal en la caleta de Máncora, Mayo 1986-Junio 1988," Claudia Wosnitza-Mendo, Marco Espino, and Maria Veliz, "La pesquerial artesanal en el Peru durante junio de 1986 a junio de 1988," *Informe*, (IMARPE: Callao, 1988), pp. 18-21.

_____."Descripción del puerto de llo, Mayo 1986-Mayo 1988," in Claudia Wosnitza-Mendo, Marco Espino, and Maria Veliz, "La pesquerial artesanal en el Peru durante junio de 1986 a junio de 1988," *Informe*, (IMARPE: Callao, 1988), pp. 99-104.

Parrish, Richard. "Environmental variations and the validity of stock assessment of highly migratory species," paper delivered at the Second International Swordfish Symposium, March 4, 1997, Turtle Bay, Oahu, Hawaii.

_____. "Regime scale climatic variations in the north Pacific and implications for highly migratory species," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

Pastor, Eduardo Sindicato Pesquero, personal communications, May 29 and June 3 and 6, 1997.

Peruano, various issues.

Peruvian Government. Decreto Ley N°25977 and implementing regulations, Decreto Supremo N°001-94-PE.

_____. Constitutional Articles 98/99, July 12, 1979.

_____. Constitutional Article 54, December 29, 1993.

_____. Decreto Supremo (DS), August 1, 1947.

_____. DS N°008-84-PE.

_____. DS N°014-87-PE

_____. DS N°010-88-PE

_____. DS N°060-91-EF, March 22, 1991.

_____. Law N°15720, November 11, 1965.

_____. Ley General de Pesqueria N°24790.

_____. Resolucón Ministerial (RM), N°120-94-PE.

_____. Resolución Supremo (RS) N°008-82-PE, "Plan de Ordanamiento Pesquero del Atún y Especies Afines."

_____. RS N°010-94-PE, March 24, 1994.

Pesca, various issues.

Plotkin, Pamela T., Richard A. Byles, and David W. Owens, "Migratory and reproductive behavior of *Lepidochelys olivacea* in the eastern Pacific Ocean," in Barbara A. Schroeder and Blair E. Witherington, compilers, "Proceedings of the Thirteenth Annual Symposium on sea turtle biology and conservation," *NOAA Technical Memorandum*,NMFS-SEFSC-341(NMFS-SEFSC: Miami, January 1994), p. 138.

Polovina, Jeffrey. "The oceanography of the swordfish fishery grounds in the central north Pacific based on satellite altimetry," paper delivered at the Second International Swordfish Symposium, March 4, 1997, Turtle Bay, Oahu, Hawaii.

PRELA, various broadcasts.

Reeb, Carol and Barbara Block. "Genetic analysis of Pacific swordfish populations using mtDNA and microsatellite markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii., p. 6.

(La) Republica, various issues.

Roemer, Michael R. *Fishing for Growth* (Harvard University Press: Cambridge, 1970).

Rocha Freyre, Gladys Liliana. Directora Nacional de Extracción, Ministerio de Pesquería, personal communications, Oficio N°277-96-PE/DNE-Dop, February 7, 1996.

Salas, Ramon. SIPESCA, personal communications, August 26 and September 1, 1997.

Sánchez V., Enrique. Eulalio Carrillo F., and Jaime Cisneros S. "Pesca experimental con palangre o long-line a bordo de una lancha anchovetera," *Informe*, N°69 (IMARPE: Callao, 1979)

Santiago Domestic Service, 2140 GMT, September 6, 1984.

Santiago, Television Nacional de Chile Network, 1800 GMT, April 23, 1990.

Schmidt, Hans Louis. General Manager, Pesquera Omega. Personal communications, April 8, 1996.

Schwing, Frank. Supervisory Oceanographer, Southwest Fisheries Science Center, presentation on El Niño at the 1997 Chile-United States Fishery Cooperation Talks, Seattle, Washington, July 26, 1997.

Seafood Leader, November-December, 1994.

Seki, Michael. "Diet and role of feeding ecology in observed swordfish distribution and catch patterns in the north Pacific," "Second International Pacific Symposium," Turtle Bay, Hawaii, March 4, 1997.

Shapiro, Sidney. *The Fisheries of Chile* (Bureau of Commercial Fisheries: Washington, D.C., 1965), pp. 2-3.

Smith, Robert O. "La industria peruana de congelación de pez espada y atún," *Pesca y Caza*, N°2, 1951.

(El) Sol, July 15, 1996.

Solar, Enrique. Personal communications, May 29, 1986.

Sosa-Nishizaki, Oscar and Makato Shimizu. "Spatial and temporal CPUE trends and stock unit inferred from them for the Pacific swordfish caught by the Japanese tuna longline fishery," *Bull. Nat. Res. Far Seas Fish.*, No. 28, March, 1991, pp. 77-85.

Television Peruana (Lima), 1100 GMT, June 6, 1989.

(La) Tercera de la Hora, July 14, 1984.

Tomczak, Matthias and J. Stuart Godfrey. *Regional Oceanography: An Introduction* (Tarrytown, New York: Pergamon, 1994).

Tovar Serpa, Humberto and Humberto Fuentes Tapia. "Magnitud poblacional de lobos marinos en el litoral peruano en marzo de 1984," *Informe*, N°88 (IMARPE: Callao, 1984), p. 12.

Tuna Research Center (TRC). *Annual Catch Statistics of Taiwanese Tuna Longline Fishery* (Institute of Oceanography: Taipei, December 1993).

U.S. Consulate General, Guayaquil. November 20, 1979.

U.S. Department of State. "Tuna situation off Ecuador and Peru," message number 354205, December 14, 1983.

U.S. Embassy, Lima. various cables.

U.S. Embassy, Quito. January 21, 1987.

U.S. Embassy, Santiago. various cables.

Uozumi, Yuji and Kotoro Yokawa. "Country report of Japan for the swordfish fisheries in the Pacific Ocean," paper delivered at the Second International Swordfish Symposium, March 3, 1997, Turtle Bay, Oahu, Hawaii, p.6.

Uozumi, Yuji. Distant Water Fishery Research Laboratory. Personal communications, February 6, 1997.

Webster, Robert. *Fishing Programs Required to Maximize Catch Rates in Peruvian waters* (Sea Sources Ltd.: Harvey's Lake, Pennsylvania, 1995).

Weidner, Dennis. "Peruvian tuna and bonito fisheries," *International Fishery Reports* (IFR-76/182), August 31, 1976.

_____. "Peruvian tuna fishery," *International Fishery Reports* (IFR-87/31), May 19, 1987.

Weidner, Dennis and Francisco Quintanilla. "Peruvian bilateral fishery relations," *International Fishery Reports* (IFR-88/88), September 2, 1988, 22p.

Weidner, Dennis and Tracey Thomas. "Cuban Fishery Relations in the Americas, 1959-88," *International Fishery Reports* (IFR-89/39), May 5, 1989, 33p.

Wong, Luis, Jesús Rodríguez, and Aurea Muguruza.1 "Utilizació del tollo-tiburón congelado en la elaboración de seco-salado 'tipo bacalao' y su estudio de preservabilidad," *Revista Latinóamericana Técnolohia de Alimentos Pesqueros*, No. 3, December 1986, pp. 11-76.

World Fishing, June, 1996, p. 9.

Wosnitza-Mendo, Claudia, Marco Espino, and Maria Veliz. "La pesquería artesanal en el Peru durante Junio de 1986 a Junio de 1988," *Informe* No. 93, (IMARPE/GTZ: Callao, 1988), 144p.

Zegarra, Carol. PROMPERU. Personal communications, February 3 and 10, 1997.

Zuzunaga Zuzunaga, Jorge. Director Ejecutivo, Instituto del Mar. Personal communications, Of. N°DE-300-133-96-PE/IMP, February 26, 1996 and Of. N°DE-300-577-97-PE/IMP, August 14, 1997.

ENDNOTES

SECTION I. (INDUSTRY OVERVIEW)

1. A good review of the development and state of the anchovy fishery and fishmeal industry before the catastrophic 1972 el Niño is available in Michael Roemer, *Fishing for Growth* (Harvard University Press, Cambridge, 1970), 208 p.

2. PESCA-PERU workers insist that the company has never required deficit funding and that the operations are highly efficient. Oscar Montes Velasquez, General Secretary, National Federation of Peruvian Fishery Workers as cited in "COPRI presents new privatization schedule for this year," *La Republica*, May 28, 1997.

3. Alejandro Bermejo, "Alan Garcia declará la guerra," *Expreso*, February 24, 1990.

4. "Informe de secretario Aprista refutó Ministro de Pesquería," *El Comercio*, October 12, 1984.

5. Protests have continued with charges that the Administration is virtually giving away company assets to Chilean interests. "Protesta de pescadores peruanos," *El Mercurio*, October 29, 1992. The Peruvian political culture appears to have changed significantly during the 1990s. Protests and allegations about foreign investors, however, do not seem to have the same impact as in the past.

6. "COPRE presents ...," *op. cit.*

7. See for example, "Hoy subastan pesqueras de Chancay a Tambo de Mora," *El Sol*, July 15, 1996.

8. "COPRE presents ...," *op. cit.*

9. The Tambo de Mora fish meal plant was to be auctioned on August 28, 1997 at a base price lowered to $4.2 million. "Pescaperu refineries privatization update," *Expreso* (internet version), August 5, 1997.

10. U.S. Embassy, Lima, "Peru: Fishing industry report," December 1994, p. 1.

11. Eduardo Loyaza, personal communications, February 13, 1996.

12. "Peru fleet to pay for fish," *Fishing News International*, April 1997, p. 48.

13. "Fishmeal stocks to fall on lower production," *WorldFish Report*, June 19, 1997, p. SP/7. It is always difficult to predict the intensity and duration of El Niño events, but there are indicators suggesting that the 1997-98 El Niño may be a powerful event. Frank Schwing, Supervisory Oceanographer, Southwest Fisheries Science Center, presentation on El Niño at the 1997 Chile-United States Fishery Cooperation Talks, Seattle, Washington, July 26, 1997.

14. A useful review of efforts in Peru and two other nearby countries (Ecuador and Colombia) to modernize their fishing industry is available in Peggy Parker, "South America looks to the future," *Seafood Business*, November-December 1995, pp. 20, 22.

15. Eduardo Pastor, Sindicato Pesquero, personal communications, June 6, 1997.

16. Juan Neyra Balta, "Pesquera atunera: Anhelo y desafío," *Pesca*, July-August 1995, p. 25.

17. Antonio Landa C., "Datos sobre la pesquería de atún aleta amarilla y barrilete en la zona económica exclusiva del Perú 1970-1977," *Rev. Com. Perm. Pacífico Sur*, vol. 11, 1980, pp. 457-472.

18. Two of the most important attempts have been PEPESCA (state corporation focusing on purse seining) and Tuna Latin (private corporation focusing on longlining). For details see the "Companies" chapter.

19. For details see the Ecuadorean and Chilean chapters.

20. Dennis Weidner, "Peruvian tuna and bonito fisheries," *International Fishery Reports* (IFR/76-182), August 31, 1976 and Dennis Weidner, "Peruvian tuna fishery," *International Fishery Reports* (IFR/87-31) May 19, 1987.

21. See "Companies" for details.

22. Collao, *op. cit.*, July 22, 1997.

23. Anonymous IMARPE official, personal communications, August 26, 1997.

24. Javier Barendiran, Commercial Section, Grupo Sotomayor, personal communications, June 12, 1997.

25. Albertina K. Ameya K., Director de Estudios Economicos y Evaluación de Recursos Potenciales, IMARPE, personal communications, August 14, 1997.

26. Pastor, *op. cit.*, June 6, 1997.

SECTION II. (SPECIES)

27. Yuji Uozumi, Distant Water Fishery Research Laboratory, personal communications, February 6, 1997.

28. See the Latin American overview of this report for a review of theories on the stock structure of Pacific swordfish.

29. Actual catches are, of course, not necessarily a good indicator of abundance, but they are currently one of the few indicators available to the authors.

30. Peruvian accounts report that the primary fishery was off the northern coast, although lesser quantities have been landed in the south. The authors know of no significant swordfish landings along the northcentral coast. Japanese longline data consistently show an area along the northcentral coast where swordfish catches and yields are poor. Fabio Carocci and Jacek Majkowski, *Pacific Tunas and Billfishes,* (FAO: Rome, 1996), map 13; Yuji Uozumi and Kotaro Yokawa, "Country report for the swordfish fisheries in the Pacific Ocean," paper delivered at the Second International Swordfish Symposium, March 3, 1997, Turtle Bay, Oahu, Hawaii, p. 6; and Oscar Sosa-Nishizaki and Makato Shimizu, "Spatial and temporal CPUE trends and stock unit inferred from them for the Pacific swordfish caught by the Japanese tuna longline fishery," *Bull. Nat. Res. Far Seas Fish.*, No. 28, March 1991, pp. 80-85. One study shows an area of moderate catch rates along the Peruvian coast, but poor catch rates further offshore. Hideki Nakano, "Stock status of swordfish in the Pacific Ocean inferred from standardized CPUE of the Japanese longline fishery using general linear models," in press as of March 1997, fig. 2.

31. This has been well documented in various swordfish fisheries. The north Pacific fisheries have been studied in detail. See for example Jeffrey Polovina, "The oceanographic features of the swordfish fishery grounds in the central north Pacific based on satellite altimetry and an ocean circulation model," in "Second International Pacific Symposium," Turtle Bay, Hawaii, March 4, 1997.

32. Uozumi and Yokawa, "Country report ...," *op. cit.*, p. 6.

33. See "Fishing Grounds" for a description of the offshore current structure.

34. José Echeandía Zegarra, Gerente, TRAMARSA, personal communications, July 19, 1996.

35. Available Ecuadorean catch data is limited. The best available data may be estimated from import data (Ecuador, appendix B2a). In addition, as swordfish is an incidental catch, results could be affected by varying strategies used to target other species, primarily tunas.

36. For details see the Ecuadorean chapter of this report.

37. See the Chilean chapter of this report for details.

38. Carocci and Majkowski, *Pacific Tunas and Billfish, op. cit.*, map 13.

39. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

40. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

41. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

42. Carocci and Majkowski, *Pacific Tunas and Billfish, op. cit.*, map 13.

43. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

44. Uozumi and Yokawa, "Country report ...," *op. cit.*, p.6.

45. See figure 1 displaying the geographic distribution of swordfish catches in Yuji Uozumi and Kotaro Yokawa, "Country report for the swordfish fisheries in the Pacific Ocean," paper delivered at the Second International Swordfish Symposium, March 3, 1997, Turtle Bay, Oahu, Hawaii, p. 6.

46. Nakano, "Stock status of swordfish ...," *op. cit.*, fig. 2. The pattern for actual catches in the 1990s is somewhat different with very substantial catches reported in the offshore areas. Uozumi and Yokawa, "Country report ...," *op. cit.*, p. 6.

47. Nakano, "Stock status of swordfish ...," *op. cit.*, fig. 2 and Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

48. Another view of this southeastern Pacific cluster is available in Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13. This also study includes data from other Asian longline fishery. Caution has to be used in drawing firm conclusions from the Japanese and other Asian longline data because swordfish was usually not the target species. The Japanese in recent years have generally targeted bigeye. Notably a southeastern Pacific cluster of bigeye catches also appear in the Asian data. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 3.

49. Carocci and Majkowski, *Pacific Tunas and Billfish, op. cit.*, map 13.

50. For details see the Chilean chapter of this report.

51. Echeandía Zegarra, *op. cit.*, July 19, 1996 and Salas, *op. cit.*, September 1, 1997.

52. Ramon Salas, SIPESA, personal communications, August 26, 1997. Mr. Salas is a Chilean fishing vessel captain currently working with SIPESA's new longliners.

53. Schmidt, *op. cit.*, April 8, 1996. Another observer suggests operations at 80-84°W off Callao which would be about 750 kilometers. Salas, *op. cit.*, August 26, 1997.

54. Salas, *op. cit.*, August 26, 1997.

55. For details see the Chilean chapter of this report.

56. Hideki Nakano, Distant Water Fishery Research Laboratory, presentation at the First International Symposium on Pacific Swordfish, Ensenada, Mexico, December 11-14, 1994.

57. Javier Chong Lay-Son, Universidad Católica de Sma. Concepción, personal communications, December 4, 1996.

58. Carol Reeb and Barbara Block, "Genetic analysis of Pacific swordfish populations using mtDNA and microsatellite markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

59. Reeb and Block, "Genetic analysis ...," *op. cit.*

60. Reeb and Block, "Genetic analysis ...," *op. cit.*

61. Naritoshi Cho, "An attempt to clarify genetic stock structure of swordfish using nuclear gene markers," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

62. For details see the Chilean chapter of this report.

63. There are a variety of limitations associated with using fisheries-dependent data as described above. It is, however, given the paucity of other data one of the few indicators available to the authors.

64. Norman W. Bartoo, Atilio L. Coan Jr., "An assessment of the Pacific swordfish resource," in Richard H. Strod, (ed.) *Planning the Future of Billfishes: Research and Management in the 1990s and Beyond* (National Coalition for Marine Conservation: Savannah, Georgia, 1989), pp. 143-144.

65. Pastor, *op. cit.*, June 6, 1997.

66. Smith, "La industria pesquera ...," *op. cit.*

67. The company had planned to focus primarily on the northern coast. Pastor, *op. cit.*, June 6, 1997. Initial results, however, have been much better off the southern coast. One of the captains involved reports water temperatures in the north of up to 25-27°C and believes this may be a least in part the cause of the poor catches. Salas, *op. cit.*, September 1, 1997.

68. Jorge Campos, Manager, Consorcio Pesquero, personal communications, January 25, 1996.

69. Salas, *op. cit.*, September 1, 1997.

70. Even if swordfish was the target species, fisheries-dependent data must always be used with caution to estimate distribution because it reveals what is caught and not necessarily actual populations. Gear and fishing strategies, for example, could only be targeting part of the available resource. When the data is derived from a fishery in which the species studied was not the target species, the data becomes even more suspect.

71. The Japanese longline fishery, given the many years of operations and increasing refinement in fishing technology, may be more effectively utilizing the available resource than many other fisheries. The primary problem with the Japanese swordfish data, however, is that swordfish is not generally the target species. Some of the fluctuations in swordfish catches therefore may reflect market trends and changes in fishing technology and strategy directed at the principal target species, tuna.

72. Uozumi and Yokawa, "Country report ...," *op. cit.*, p. 6.

73. Some swordfish were taken along the coast, however, at these central latitudes. Nakano, "Stock status of swordfish ...," *op. cit.*, figure 2.

74. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

75. Alejandro Covarrubias, Director de Fiscalización, Servicio Nacional de Pesca (Chile), personal communications, July 21, 1996.

76. José Echeandía Zegarra, General Manager, TRAMARSA, personal communications, July 22, 1996 and June 3, 1997.

77. Salas, *op. cit.*, September 1, 1997.

78. Salas, *op. cit.*, September 1, 1997.

79. The study focused primarily on tuna, but there was a swordfish by-catch reported. Carlos Martínez,"Prospección de atunes y peces espadas en el Océano Pacífico oriental al este de los 110°W: Segundo semestre de 1971," (IFOP N° inven: 740002), December 1974.

80. Tuna Research Center (TRC), *Annual Catch Statistics of Taiwanese Tuna Longline Fishery* (Institute of Oceanography: Taipei, December 1993), F21-24.

81. TRC, *Annual Catch Statistics ...*, *op. cit.*, F21-25.

82. National Fisheries Research and Development Agency, "Fishery statistics and fishing grounds for the Korean tuna longline fishery," *Technical Report*, No. 106, December 1993, pp. 87, 157, 227, 297, and 367.

83. The fact that swordfish was not the target species in the Japanese longline fishery, the most complete available data set, further complicate assessing seasonal patterns.

84. There is a more detailed discussion of this theoretical circular migratory route in the Chilean chapter of this study.

85. For details of the possible migratory path off Chile, see the Chilean chapter of this report.

86. Pastor, *op. cit.*, June 6, 1997.

87. Some interesting work has been done, however, on adults. See Guillermo Podesta, "Aspects of swordfish oceanography in the Atlantic," paper presented at the Second International Swordfish Symposium, Turtle Bay, Hawaii, March 4, 1997.

88. Edward DeMartini, "Sex and size composition in the Hawaiian-based longline fishery," Second International Pacific Symposium, Turtle Bay, Hawaii, March 4, 1997.

89. Carocci and Majkowski, *Pacific Tunas and Billfish, op. cit.*, map 13.

90. For details see the Chilean chapter of this report.

91. M. A. Barbieri, M. Donoso, A. Gonzalez, V. Correa, B. Leiva, and A. Montiel, "Development and state of the art of the swordfish fishery in Chile," paper delivered at the International Symposium on Pacific Swordfish, Ensenada, B.C., Mexico, December 11-14, 1994, figure 10.

92. See the Chilean chapter of this study for details.

93. Salas, *op. cit.*, August 26, 1997.

94. A. S. Grechina and D. F. Arcos, "Distribución y migración del jurel, *Trachurus symmetricus murphyi* (Nichols), en el Pacífico suroriental, *Guyana Oceanol*, Vol. 3, No. 1, 1995, pp. 3-27.

95. IMARPE, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-1992," *Informe*, No. 105 (IMARPE: Callao, March 1994), pp. 63-202.

96. IMARPE, "Estadísticas de los desembarques ..., 1983-1992," *op. cit*, pp. 23-42.

97. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

98. Most ETP coastal countries report that swordfish larvae are not found east of 110°W. One Ecuadorean researcher, however, has reported the presence of swordfish larvae in coastal waters. (See "Spawning.")

99. Carocci and Majkowski, *Pacific Tunas and Billfish, op. cit.*, map 13.

100. Emira Antonietti, IMARPE, personal communications, March 24, 1997.

101. The five foreign companies which purchased licenses landed only 3,000 t of an anticipated 100,000 t catch. The companies paid $23 million for fishing licenses and lost production cost the companies $50 million more. "Elusive squid cause Peruvian headache," *Seafood International*, April 1997, p. 8.

102. Reeb and Block, "Genetic analysis ...," *op. cit.*

103. U.S. tagging data show some movement of fish in the north Pacific between the Hawaiian Islands and the mainland waters off California.

104. Uozumi and Yokawa, "Country report ...," *op. cit.*; Nakano, "Stock status ...," *op. cit.*; and Sosa-Nishizaki, "Spatial and temporal CPUE trends ..., *op. cit.* Also see the Mexican and Central American chapters of this report.

105. While the shift is no perfect, this is the general pattern. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

106. Antonietti, *op. cit.*, March 13, 1997.

107. See each country chapter for details.

108. The most comprehensive Pacific study of oceanic fish larvae has been conducted by the Japanese National Far Seas Fisheries Research Institute (JFSFRL). Researchers with the JFSFRL failed to find any swordfish larvae east of 108°W, although they did not test waters south of 12°S. Nisikawa, Honma, Yueyanagi, and Kikawa, *Average Distribution of Larval Oceanic Species of Scombroid Fishes, 1956-81* (Far Seas Fisheries Research Laboratory: Shimizu, Japan, 1985), Series S No. 12. Other larval studies have included: CALCOFI, EASTROPAC I and II, and the Soviets (R/V *Akademik Kurchatov* - cruise 17). They have all failed to find swordfish larvae east of 108°W. While these surveys were not designed specifically for swordfish, they did encounter larvae of similar species (such as frigate mackerel and sailfish). If swordfish larvae had been present, they would have presumably also have noted that. Larvae of several other oceanic species such as bigeye and yellowfin tuna were also absent or extremely rare. Researchers are unsure as to why spawning of these oceanic species does not appear to be taking place in the ETP--despite appropriate temperatures and salinities. Robert Humphreys, "Review of larvae and juvenile distributions with inference towards spawning habitat," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

109. M. Angela Barbieri Bellolio, J. Miguel Donoso Pastor, Eleuterio Yáñez Rodríguez, Antonio González Casanga, Víctor Catasti Barraza, Marcelo García Alvarado, "Monitoreo de la pesquería de recurso pez espada (I-X Regiones, 1994,)" Proyecto FIPA N°11/93 (IFOP: Valparaíso, November, 1995), p. 64.

110. Nisikawa, Honma, Yueyanagi, and Kikawa, *Average Distribution of Larval Oceanic Species of Scrombroid Fishes, 1956-81*, *op. cit.*

111. The assessment of Chilean swordfish seasonality is based on catch data published by SERNAP since the mid-1980s.

112. Pastor, *op. cit.*, June 6, 1997.

113. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ..., *op. cit.*, pp. 80-85.

114. Carocci and Majkowski, *Pacific Tunas and Billfish, op. cit.*, map 13.

115. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13; Uozumi and Yokawa, "Country report ...," *op. cit.*, p. 6; and Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85.

116. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

117. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

118. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ..., *op. cit.*, pp. 80-85.

119. For details see the Chilean chapter of this report.

120. S. Kip Farrington, Jr., *Fishing the Pacific: Offshore and On* (New York: Coward-McCann, 1953), pp. 15-16.

121. Farrington, *Fishing the Pacific*, *op. cit.*, pp. 44 and 67.

122. Smith, "La industria Peruana ..." *op. cit.*, p. 7.

123. Maria Angela Barbieri, Jefe, Departamento de Tecnología Pesquera, Instituto de Fomento Pesquero (Chile), personal communications, April 9, 1996 and Hans Louis Schmidt, General Manager, Pesquera Omega (Chile), personal communications, April 8, 1996.

124. Mike Justen, NMFS-F/SWR, personal communications, October 19, 1995.

125. Echeandía Zegarra, *op. cit.*, June 26 and July 22, 1996.

126. For details see the Chilean chapter of this report. The Chileans can operate within the 200-mile zone while the Spanish cannot. This difference in grounds, in addition to other factors (such as gear, vessels, experience, and fishing strategy), could cause differences in size distribution.

127. See for example Michael Seki, "Diet and role of feeding ecology in observed swordfish distribution and catch patterns in the north Pacific," "Second International Pacific Symposium," Turtle Bay, Hawaii, March 4, 1997.

128. Smith, "La industria Peruana ..." *op. cit.*, p. 7.

129. For details see the Chilean chapter of this report.

130. Salas, *op. cit.*, September 1, 1997.

131. Fishermen off southern Peru and Chile report minimal squid catches.

132. Pastor, *op. cit.*, June 6, 1997.

133. The squid catch is primarily taken by foreign jiggers and is thus not reported by port in Peruvian statistics (appendix B7b1-2). Almost all of the fishing by the foreign vessels , however, is conducted off the northern coast.

134. Sosa-Nishizaki and Shimizu, "Spatial and temporal CPUE trends ...," *op. cit.*, pp. 80-85. Another assessment of seasonality in the Japanese longline fishery suggests the best fishing off Ecuador and northern Peru early in the year, although the seasonality is not as marked as in the south. Carocci and Majkowski, *Pacific Tunas and Billfish, op. cit.*, map 13.

135. The commercial fishery for giant squid was initiated in 1991-92 by foreign jiggers. As a result, significant squid catch data is available only beginning in 1991.

136. Nakano, "Stock status of swordfish ...," *op. cit.*, fig. 8.

137. Nakano, *op. cit.*, December 11-14, 1994.

138. Nakano, "Stock status of swordfish ...," pp. 10-11.

139. Richard Parrish, "Regime scale climatic variations in the north Pacific and implications for highly migratory species," paper delivered at the Second International Swordfish Symposium, March 5, 1997, Turtle Bay, Oahu, Hawaii.

140. Nakano, "Stock status of swordfish ...," *op. cit,* p. 8.

141. For details see the Chilean chapter of this report.

142. Swordfish may not have preyed extensively on the principal small pelagic (anchovy), but they do prey upon squid and other species which do feed extensively on anchovy.

143. Bartoo and Coan, "An assessment ...," *op. cit.*, pp. 143-144.

144. Nakano, "Stock status of swordfish ...," *op. cit.*, fig. 9.

145. Pastor, *op. cit.*, June 6, 1997.

146. Job growth in other areas, such as mining, may have been an even more important factor.

SECTION III. (FISHING GROUNDS)

147. Matthias Tomczak and J. Stuart Godfrey, *Regional Oceanography: An Introduction* (Tarrytown, New York: Pergamon, 1994), p. 144.

148. A more detailed discussion of the Humboldt Current is available in Tomczak and Godfrey, *Regional Oceanography, op. cit.*, p. 144.

149. Sydney Levitus and Timothy P. Boyer, "World Ocean Atlas 1994: Temperature," *NOAA Atlas NESDIS 4*, Vol. 4 (National Environmental Satellite, Data, and Information Service: Washington, D.C., June, 1994), pp. 45-50.

150. Tomczak and Godfrey, *Regional Oceanography, op. cit.*, p. 144.

151. Sidney Shapiro, *The Fisheries of Chile* (Bureau of Commercial Fisheries: Washington, D.C., 1965), pp. 2-3.

152. A more detailed discussion of the Chile/Peru upwelling system is available in Tomczak and Godfrey, *Regional Oceanography, op. cit.*, pp. 144-145.

153. Robert O. Smith, "La industria peruana de congelación de pez espada y atún," *Pesca y Caza*, N°2, 1951.

154. D.P. De Sylva, "Red-water blooms off northern Chile, April-May 1956, with reference to the ecology of the swordfish and striped marlin," *Pacific Science*, 1962, Vol. XVI, No. 3, pp. 271-279. Two excellent recent descriptions of this phenomenon are available in Don Olson, X. Humston, and Guillermo Podesta, "Large pelagics in frontal zone environments;" Jeffrey Polovina, "The oceanography of the swordfish fishery grounds in the central north Pacific based on satellite altimetry;" and Keith Bigelow, "Influence of environmental factors on swordfish catch rates," papers delivered at the Second International Swordfish Symposium, March 4, 1997, Turtle

Bay, Oahu, Hawaii.

155. Smith, "La industria Peruana ...," *op. cit.*

156. Smith, "La industria Peruana ...," *op. cit.*

157. Barbieri, *op. cit.*, April 11, 1996.

158. The primary Japanese fishery is to the northeast of the Nazca Ridge. Uozumi and Yokawa, "Country report ...," *op. cit.*, fig. 1.

159. Farrington, *Fishing the Pacific*, *op. cit.*, pp. 56-58 and 75.

SECTION IV. (FLEET)

160. Jorge Zuzunaga Zuzunaga, Executive Director, Instituto del Mar (IMARPE-RJS), personal communications, August 14, 1997.

161. Eduardo Pastor, Sindicato Pesquero, personal communications, May 29, 1997.

162. Campos, *op. cit.*, May 28, 1997.

163. Zuzunaga Zuzunaga, *op. cit.*, August 14, 1997.

164. Claudia Wosnitza-Mendo, Marco Espino, Maria Veliz, La Pesquería Artesanal en el Peru durante Junio de 1986 a Junio de 1988, *Informe* No. 93, (IMARPE/GTZ: Callao, 1988), pp. 81-82, 119.

165. "New technology provides more profit with less pollution," *World Fishing*, June 1996, p. 9.

166. "Peru: Change quantity to quality," *Fishing News International*, August 1995, pp. 14-15.

167. Webster, *Fishing Programs ...*, *op. cit.*, p. 134.

168. Jorge Zuzunaga Zuzunaga, Director Ejecutivo, Instituto del Mar, personal communications, Of. N°DE-300-133-96-PE/IMP, February 26, 1996.

169. Ursino González, Hotel Merlin, personal communications, February 6, 1997.

170. Tuna Latin and Consorcio Pesquero have both reported unsuccessful efforts. Tuna Latin maintains that fishing operations were successful, but their efforts failed because of Government policies. Máximo Collao, General Manager, Tuna Latin, personal communications, July 22, 1997. Pesquera Atlantis' efforts are more recent and the results still unclear. Unconfirmed assessments such that the results have been somewhat disappointing. For details see "Companies".

171. Most of the larger Peruvian fishing vessels are trawlers and seiners, but there are also a few longliners.

172. Ludwig Meier Cornejo, *El Futuro de la Pesquería: Corrigiendo los Errores del Pasado* (Lima: Instituto de Estudios Pesqueros, July 1990), p. 42.

173. Webster, *Fishing Programs ...*, *op. cit.*, p. 1.

174. Campos, *op. cit.*, January 25, 1996.

175. Jorge Campos, Manager, Productos Pesquero Peruano, personal communications, May 28, 1997.

76. Webster, *Fishing Programs ...*, *op. cit.*, p. 4.

77. Echeandía Zegarra, *op. cit.*, July 3, 1997.

78. Campos, *op. cit.*, May 28, 1997.

79. Campos, *op. cit.*, May 28, 1997.

80. Much of the focus of foreign interest during the 1930s-50s was Chile. See the Chilean chapter of this report or details.

81. Enrique Pardo, the son of a former president, even imported a boat for recreational fishing in 1948. Farrington, *Fishing the Pacific*, *op. cit.*, pp. 58 and 68.

82. Carol Zegarra, PROMPERU, personal communications, February 3, 1997.

83. González, *op. cit.*, February 6, 1997.

84. "'Gigantes del mar' frente al Callao," *El Comercio*, June 1, 1997.

85. The Hotel Las Arenas de Máncora in Máncora near Piura has zodiacs available. Expediciones Viento Sur offers trips in the Lima area to the Islas Hormiga which can include some fishing, but the sailboats they used are not equipped for billfish. Zegarra , *op. cit.*, February 10, 1997.

86. The general characteristics of the Japanese vessels are described in the Japanese chapter of this report. See Wildman, "Asia," *op. cit.*

87. Campos, *op. cit.*, January 25, 1996.

88. Details on the Spanish fleet and fishing companies deploying them are described in the Spanish chapter of this study. See: Folsom, "Western Europe" *op. cit.*

89. The authors have received different reports on the size (appendix A2).

90. José Echeandía Zegarra, General Manager, TRAMARSA, personal communications, June 21 and July 22, 1996.

SECTION V. (SHIPYARDS)

91. For details see Weidner and Hall, "Latin America." *op. cit.*, pp. 424-428.

92. Pedro Chang Wong, Gerente de Producción, Navales Industriales, December 13, 1995.

93. See for example "40 seiners building--As the fleet switches to deeper mackerel," *Fishing News International*, August 1995, pp. 24-25.

94. Chang Wong, *op. cit.*, December 13, 1995.

95. "Peru purser caries 'copter,'" *Fishing News International*, January 1997.

96. "Peru purser caries 'copter,'" *op. cit.*

97. Chang Wong, *op. cit.*, January 18, 1996.

98. José Echeandía Zegarra, General Manager, TRAMARSA, personal communications, June 26, 1996.

199. Pastor, *op. cit.*, May 29, 1997.

200. Decreto Supremo N°060-91-EF, March 22, 1991.

201. Máximo Collao, General Manager, Tuna Latin, personal communications, June 27, 1996.

SECTION VI. (FLEET OPERATIONS AND GEAR)

202. Farrington, *Fishing the Pacific*, *op. cit.*, p. 67.

203. Smith, "La industria Peruana ..." *op. cit.*, p. 7.

204. Pastor, *op. cit.*, June 3, 1997.

205. Campos, *op. cit.*, May 28, 1997.

206. Pastor, *op. cit.*, May 29, 1997.

207. Campos, *op. cit.*, May 28, 1997.

208. Robert Webster, *Fishing Programs Required to Maximize Catch Rates in Peruvian waters* (Sea Sources Ltd.: Harvey's Lake, Pennsylvania, 1995), p. 12.

209. Pastor, *op. cit.*, May 29, 1997.

210. Salas, *op. cit.*, September 1, 1997. For details on Chilean gear and methods see the Chilean chapter of this report.

211. Webster, *Fishing Programs ...*, *op. cit*, pp. 4, 12.

212. Pastor, *op. cit.*, May 29, 1997.

213. Zuzunaga Zuzunaga, *op. cit.*, February 26, 1996.

214. Echeandía Zegarra, *op. cit.*, July 2, 1996 and June 3, 1997.

215. Pastor, *op. cit.*, May 30, 1997.

216. For details, see the Chilean chapter of this study. Farrington reports that Alfred Glassel was particularly active off Peru during the early 1950s. Farrington, *Fishing the Pacific*, *op. cit.*, p. 4, 10-11, and 17.

217. Farrington, *Fishing the Pacific*, *op. cit.*, pp. 56-58.

218. Farrington, *Fishing the Pacific*, *op. cit.*, pp. 64-66.

219. See, for example, Farrington, *Fishing the Pacific*, *op. cit.*, pp. 12-13, 16, 59-63, 68, and 71.

220. Farrington, *Fishing the Pacific*, *op. cit.*, pp. 58-59.

221. González, *op. cit.*, February 6, 1997.

222. Emira Antonetti, Director of Research, IMARPE, personal communications, June 20, 1996.

223. Zegarra, *op. cit.*, February 3, 1997.

224. González, *op. cit.*, February 6, 1997.

225. "Palm beach boat 'busy' off Peru," *The International Angler*, month unknown, 1997, p. 3.

226. Two suggestions were the Hotel Las Arenas de Máncora in Máncora and Expediciones Viento Sur in Lima. Zegarra, *op. cit.*, February 10, 1997.

227. "'Gigantes del mar' frente al Callao," *El Comercio*, June 1, 1997.

228. Japanese distant-water operations are described in the Japanese chapter of this study. See Wildman, "Asia," *op. cit.*

229. Uozumi and Yokawa, "Country report ...", *op. cit.*, p. 6 and Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 13.

230. Echeandía Zegarra, *op. cit.*, July 22, 1996.

231. Salas, *op. cit.,* September 1, 1997.

232. If the live weight of the sharks finned was calculated the shark catch would be much more important.

233. Echeandía Zegarra, *op. cit.*, July 22, 1996.

234. I. Fernández, *op. cit.*, July 2, 1996.

235. Salas, *op. cit.,* August 26, 1997.

SECTION VII. (CATCH)

236. Smith, "La industria Peruana ..." *op. cit.*, p. 4.

237. A higher catch is suggested by EU import data, but the authors believe that much of this may be the transshipments of the Spanish vessels operating in the eastern Pacific (appendix E3).

238. For details see "Companies."

239. A good indicator of the results of the Peruvian companies deploying longliners are imports reported by the European Union, Japan, and United States. There are no known fresh swordfish imports to the European Union (appendix E3) and virtually none to Japan (appendix E4b). U.S. fresh swordfish imports from Peru, as well as other oceanic pelagics, have increased in the 1990s, but vary widely from year to year. The record year for swordfish was the 39 t reported in 1991 and for oceanic pelagics, as a group, the 189 t in 1994 (appendix E2c). Clearly the companies involved are having difficulties supplying product on a regular basis.

240. Farrington, *Fishing the Pacific*, *op. cit.*, p. 66.

241. For details on the development of the fishery in Chile, see the Chilean chapter of this study.

242. Farrington, *Fishing the Pacific*, *op. cit.*, p. 67.

243. There were virtually no commercial fisheries in Latin America for any species until after World War II. Fisheries were conducted almost entirely by artisanal fishermen. Most Latin Americans regarded fishing as a very low-status occupation. The artisanal fishermen in the region were generally very poor, often with virtually no formal education, and employed primitive gear and methods and in most cases primitive, open boats. The description of Cuban fishermen in Hemingway's classic *Old Man of the Sea* provides a good description for U.S. readers. Many artisanal fishermen pursued their craft through a strong sense of family tradition built during

several generations of fishing, often with minimal technical innovation and few economic rewards.

244. Smith, "La industria Peruana ...," *op. cit* and Farrington, *Fishing the Pacific*, *op. cit.*, p. 69.

245. Farrington, *Fishing the Pacific*, *op. cit.*, p. 66.

246. The 1950 catch of 2,600 t has only been exceeded by the Chilean swordfish fishery which total more than 7,000 t in 1991. The Chilean fishery has since declined significantly. See the Chilean chapter of this book for details.

247. Zuzunaga Zuzunaga, *op. cit.*, August 14, 1997.

248. Zuzunaga Zuzunaga, *op. cit.*, August 14, 1997.

249. The difference is unexplained, especially because FAO's source is the Peruvian Ministry of Fisheries (MIPE) and IMARPE is the research institute of the Ministry.

250. The Soviets have reported swordfish catches to FAO. Catches of as much as 1,400 t have been reported off West Africa (appendix B6). They have never, however, reported catches of that species in the southeastern Pacific.

251. Weidner and Jacobson, "Soviet fishing operations off Latin America," *op. cit.* The swordfish by catch was probably in the more coastal trawl fishery, although such a by-catch is highly unusual. Wlodzimierz Kaczynski, Research Associate Professor, Institute for Marine Studies, College of Ocean and Fishery Sciences, University of Washington, personal communications, July 9, 1997.

252. This is highly unusual as factory trawlers do not normally report significant swordfish by-catches.

253. This discrepancy is difficult to assess. The source of the FAO data is the Peruvian Ministry of Fisheries and IMARPE is a unit of the Ministry.

254. The company, however, reported generally poor results. Collao, *op. cit.*, June 27, 1997. For details see the entry for Consorcio Pesquero in the company section.

255. Echeandía Zegarra, *op. cit.*, June 21, 1996.

256. Campos, *op. cit.*, January 25, 1996.

257. Echeandía Zegarra, *op. cit.*, June 21, 1996.

258. Collao, *op. cit.*, June 27, 1996.

259. Echeandía Zegarra, *op. cit,*, June 26, 1996.

260. Campos, *op. cit.*, May 28, 1997.

261. Pastor, *op. cit.*, June 2, 1997.

262. Pastor, *op. cit.*, June 2, 1997.

SECTION VIII. (PORTS)

263. Alejandro Bermejo, "Necesitamos muelles," *Expreso*, November 3, 1991.

264. Chile is also preparing to privatize its ports. For details see the Chilean chapter of this study.

265. "Instituciones marítimas rechazan privatización de infrastructura," *La Republica*, July 10, 1996.

266. Alejandro Bermejo, "Desde Parachique hasta Tumbes," *Pesca*, November-December 1991, p. 7.

267. "Piers for landing ports," *Fishing News International*, November 1992.

268. Zuzunaga Zuzunaga, *op. cit.*, February 26, 1996.

269. "Japanese fishing boat detained in Callao on $53 mn submarine claim," *The Andean Report*, May 1989, p. 138.

270. Echeandía Zegarra, *op. cit.*, July 11, 1996.

271. Salas, *op. cit.*, September 1, 1997.

272. "Tenders: Peru," *Andean Report*, July 1985, p. 118 and R. Orozco, "Descripción del puerto de Ilo, Mayo 1986-Mayo 1988," in Wosnitza-Mendo, *et. al.*, "La pesqueria artesanal ...," *op. cit.*, pp. 99-104.

273. Zuzunaga Zuzunaga, *op. cit.*, February 26, 1996.

274. Echeandía Zegarra, *op. cit.*, June 26, 1996.

275. Echeandía Zegarra, *op. cit.*, June 26, 1996.

276. Farrington, *Fishing the Pacific*, *op. cit.*, p. 66.

277. R. Orozco, "La pesqueria artesanal en la caleta de Máncora, Mayo 1986-Junio 1988," in Wosnitza-Mendo, *et. al.*, "La pesqueria artesanal ...," *op. cit.*, pp. 18-21.

278. Alejandro Bermejo, "Paita, base pesquera del norte," *Pesca*, May278. 1971, pp. 22-23.

279. "Modern fishing port to handle food fish landings," *Fishing News International*, July 1972.

280. Alejandro Bermejo, "Desde Parachique hasta Tumbes," *Pesca*, November-December 1991, p. 7 and Alejandro Bermejo, "Estación naval frena desarrollo de Paita," *Pesca*, November-December 1990, p. 5.

281. Zuzunaga Zuzunaga, *op. cit.*, February 26, 1996.

282. Alejandro Bermejo, "Desde Parachique hasta Tumbes," *Pesca*, November-December 1991, pp. 6-8.

283. C. Moreno and A. Mendieta, "La pesqueria artesanal en la caleta de Puerto Nuevo (Paita) Julio 1986-Junio 1988," in Wosnitza-Mendo, *et. al.*, "La pesqueria artesanal ...," *op. cit.*, pp. 22-27.

SECTION IX. (TRANSSHIPMENT)

284. Gallo, *op. cit.*, June 18, 1996.

285. Zuzunaga Zuzunaga, *op. cit.*, February 27, 1996.

286. Enrique Solar, personal communications, May 29, 1986.

287. Campos, *op. cit.*, January 25, 1996.

288. For details see the Spanish and Uruguayan chapter of this study.

289. Mike Justen, NMFS-F/SWR, personal communications, October 19, 1995.

290. Some observers report some operations as far north as Ecuador. Salas, *op. cit.*, August 26, 1997.

291. One Chilean source estimates that the Spanish are fishing from the 200-mile limit out to about 800 kilometers from the coast. Schmidt, *op. cit.*, April 8, 1996. Another observer reports operations off Callao at 80-84°W which would be about 750 kilometers. Salas, *op. cit,* August 26, 1997.

292. Barbieri, *op. cit.*, April 9, 1996 and Hans Schmidt, Pesquera Omega, personal communications, April 6, 1996.

293. Echeandía Zegarra, *op. cit.*, June 26 and July 22, 1996.

294. Covarrubias, *op. cit.*, August 17, 1995. For details on Chilean transhipping regulations, see the Chilean chapter of this report.

295. Both countries, however, offer fishing licenses for foreign fishermen interested in working with local companies. For details see the Colombian and Ecuadorean chapters of this report.

296. Ronaldo Gallo, Dirección Nacional de Extracción, Ministerio de Pesquería, personal communications, June 18, 1996.

297. Echeandía Zegarra, *op. cit.*, June 26, 1996.

298. Echeandía Zegarra, *op. cit.*, June 26, 1996.

299. The Japanese have also curtailed shipments through Montevideo. Japanese sources report that there are no longer any transshipments to foreign markets and all transshipments are destined to Japan. See the Uruguayan chapter of this study for details. This shift toward at-sea transshipments appears to be part of an overall pattern. Japanese transshipments through distant-water ports continue primarily where access arrangements require that the catch be landed locally. The authors believe that the Japanese have moved toward at-sea transshipments to preserve quality and to avoid the cost and complications of transferring fish through foreign countries. See the Japanese chapter of Wildman, "Asia," *op. cit.* One of the principal ports where the Japanese still transship is Capetown, South Africa where they continue to tranship the longline catch. This may be due to access arrangements with the South Africans. See the South African chapter in Folsom, "Africa," *op. cit.* It is possible that some transshipments to Japan occur through other ports, but the authors believe such shipments are limited and there is no Japanese data available on the quantities involved. Wildman, "Asia," *op. cit.*

300. Consorcio Pesquero reports supplying product to the Japanese. Campos, *op. cit.*, January 25, 1996. The Japanese also have a relationship with Tuna Latin which leased and attempted to buy Japanese longliners. Presumably much of this product was supplied by the Japanese, but the precise registration status (Japanese or Peruvian) is unclear. For details on these two companies, see "Companies."

301. I. Fernández, *op. cit.*, July 2, 1996.

302. I. Fernández, *op. cit.*, July 2, 1996.

303. Echeandía Zegarra, *op. cit.*, June 26, 1996.

304. Julio Gallo, Ministerio de Pesquería, personal communications, June 18, 1996.

305. Echeandía Zegarra, *op. cit.*, June 21, 1996.

SECTION X. (PROCESSING AND PRODUCTS)

306. "Por precios altos se pone de moda filete de pez raya en los mercados de Lima," *El Comercio*, July 3, 1989, p. 1.

307. "Como tollos venden a fieros tiburones," *La Republica*, December 12, 1992.

308. Luis Wong, Jesús Rodríguez, and Aurea Muguruza, "Utilizació del tollo-tiburón congelado en la elaboración de seco-salado 'tipo bacalao' y su estudio de preservabilidad," *Revista Latinóamericana Técnologia de Alimentos Pesqueros*, No. 3, December 1986, pp. 11-76.

309. Zuzunaga Zuzunaga, *op. cit.*, February 26, 1996.

310. Campos, *op. cit.*, January 25, 1996.

311. Campos, *op. cit.*, May 28, 1997.

312. Pastor, *op. cit.*, June 2, 1997.

313. Echeandía Zegarra, *op. cit.*, June 3, 1997.

SECTION XI. (COMPANIES)

314. The SNP in 1995, for example, was trying to convince the Government to close most of PESCA-PERU's remaining plants rather than sell them. "Shut state meal plants," *Fishing News International*, August 1995, p. 20.

315. Collao, *op. cit.*, June 27, 1996.

316. For details see the Peruvian chapter in Weidner and Hall, "Latin America," Vol. IV, *op. cit.*

317. Bermejo, "Desde Parachique ...," *op. cit.*

318. Ivonne Diminich, Commercial Manager, Agro Pesca, personal communications, January 16, 1996.

319. If the by-catch exceeds 10 percent, the entire catch can be confiscated and the company fined. Diminich, *op. cit.*, January 19, 1996.

320. "Primera flota atunera privada peruana," *Pesca*, July-August 1988, p. 5.

321. Resolución Ministerial, N°120-94-PE and "Autorizan pesca," *La Republica*, March 23, 1994.

322. The vessels fish off both Ecuador and Chile, but outside the 200-mile zones of those countries.

323. Campos, *op. cit.*, January 25, 1996.

324. INFOPESCA, "Atun enfriado, congelado: Peru," *Noticias Comerciales*, June 20, 1995.

325. Javier Barendiran, Commercial Department, Grupo Sotomayor, personal communications, June 11, 1997.

326. Campos, *op. cit.*, May 28, 1997.

327. Barendiran, *op. cit.*, June 11, 1997.

328. "Success of the 'white elephant'," *Fishing News International*, December 1979.

329. For details see Dennis Weidner, "Peruvian tuna fishery," *International Fishery Reports* (IFR-87-31), May 19, 1987.

330. "Tuna fleet for sale," *Fishing News International*, March 1981.

331. "Cuatro ex-atuneros se convierten en jureleros," *Pesca*, September-October 1994.

332. Echeandía Zegarra, *op. cit.*, June 26 and July 2, 1996.

333. Echeandía Zegarra, *op. cit.*, June 3, 1997.

334. Campos, *op. cit.*, May 28, 1997.

335. "Peru owner plans big freezing plant," *Fishing News International*, February 1992, p. 51.

336. Bermejo, "Desde Parachique ...," *op. cit.* and Alejandro Bermejo, "Pesquero en Paita," *Pesca*, November-December 1990, pp. 7-11.

337. Pastor, *op. cit.*, June 6, 1997.

338. Eduardo Pastor, Sindicato Pesquero, personal communications, May 29, 1997.

339. Echeandía Zegarra, *op. cit.*, June 26, 1996, and June 3, 1997.

340. Máximo Collao, General Manager and Co-Owner, Tuna Latin, personal communications, June 27, 1996.

341. Collao, *op. cit.*, July 22, 1997.

342. Resolución Supremo 008-82-PE, "Plan de Ordanamiento Pesquero del Atún y Especies Afines."

343. Collao, *op. cit.*, June 27, 1996. Details on the arrangements are described in Alejandro Bermejo, "Ismael Benavides y los palangreros japoneses," *Pesca*, September-October 1988, pp. 12-13, 34.

344. Collao, *op. cit.*, June 27, 1996.

345. Retroactive provisions resulted in substantial fees the company had to pay. Collao, *op. cit.*, June 25, 1996. Both foreign and domestic vessels were required to pay fees of $500 per vessel ton and the by-catch had to be delivered free to MIPE. Company officials maintain that their operations could simply not afford such costs. One observer notes that proof that the new regulations were not viable is that since they were issued no company has attempted to enter the fishery. Collao, *op. cit.*, July 22, 1977.

346. Collao, *op. cit.*, June 25 and July 19, 1996.

347. Collao, *op. cit.*, July 30, 1996.

SECTION XII. (MARKETS)

348. Ameya, *op. cit.,* August 14, 1997.

349. See "Catch" for a detailed annual assessment of catch and export trends.

350. U.S. Embassy, Lima, message number 974, February 4, 1980.

351. It is unclear why the Spanish are reporting these shipments as imports from Peru. The Spanish Government has never reported the Pacific swordfish catch of its longliners. (FAO for example shows no Spanish swordfish catch in the Pacific (Latin America, appendix c2b.)

352. Farrington, *Fishing the Pacific*, *op. cit.*, p. 67.

353. The authors have been unable to contact the company. No increased shipments of tuna and swordfish are noted in early 1997, however, the company could be marketing its catch in Japan.

SECTION XIII. (GOVERNMENT POLICY)

354. Decreto Ley N°25977 and implementing regulations, Decreto Supremo N°001-94-PE.

355. "Estado regulará el manejo integral y explotación de recursos hidrobiológicos," *El Comercio*, December 23, 1992.

356. "Plan de ordenamiento pesquero del atún, especies afines y asociados," Resolución Ministerial N°110-94-PE, March 16, 1994.

357. Section 6.1 of the Tuna Management Plan, Resolución Ministerial, N°110-94-PE, Match 16, 1994.

358. Campos, *op. cit.*, January 25, 1996.

359. Supreme Decree, August 1, 1947; Law No. 15720, November 11, 1965; Constitutional Articles 98/99, July 12, 1979; and Constitutional Article 54, December 29, 1993.

360. U.S. Embassy, Lima, "Environmental roundup from Peru," message number 7091, August 12, 1995.

361. "FAO plan 'a disaster,'" *Fishing News International*, September 1996.

362. "Peru fleet to pay for fish," *Fishing News International*, April 1997, p. 48

363. U.S. Embassy, Lima, "Peru: Fishing industry report, 1994" *op. cit.*, pp. 8-9.

364. "Los lineamientos de política pesquera," RM 084-94-PE, *El Peruano*, March 3, 1994.

365. "Fondo de desarrollo pesquero adquirió plena vigencia," *El Comercio*, December 23, 1992, p. A12.

366. Jorge Villena Chávez, "Perú: Planificación del sistema HACCP en la industria de productos pesqueros en Perú," *CC&I* (Red de Cooperación Latinoamericana de Control de Calidad e Inspección de Productos Pesqueros: Montevideo, 1996), Vol. V, pp. 5-10.

367. See the Peruvian chapter in Weidner and Hall, "Latin America," *op. cit.*; Dennis Weidner and Francisco Quintanilla, "Peruvian bilateral fishery relations," *International Fishery Reports* (IFR-88/88), September 2, 1988, 22p.; Donald Jacobson and Dennis Weidner, "Soviet-Latin American Fishery Relations, 1961-89," *International Fishery Reports* (IFR-89/39), May 5, 1989, 153p.; and Dennis Weidner and Tracey Thomas, "Cuban Fishery Relations in the Americas, 1959-88," *International Fishery Reports* (IFR-89/39), May 5, 1989, 33p.

368. Collao, *op. cit.*, July 22, 1997.

369. "Plan de Ordenamiento Pesquero del Atún y Especies Afines," Resolución Supremo 008-82-PE.

370. U.S. Embassy, Lima, "Tuna season opens in Peru, foreign boats welcome under certain conditions," message number, 12626, December 5, 1983.

371. Decreto Supremo, N°008-84-PE. A good discussion of the licensing system is available in Alejandro Bermejo, "Ismael Benavides y los palangreros japoneses," *Pesca*, September-October 1988, pp. 12-13, 34.

372. DS N°014-87-PE, DS N°010-88-PE, and the Ley General de Pesqueria N°24790.

373. Collao, *op. cit.*, June 27, 1996.

374. Plan de Ordenamiento de la Pesquería del Atún, Resolución Ministerial N°110-PE, March 16, 1994.

375. Section 8.1 of the Tuna Management Plan, Resolución Ministerial, N°110-94-PE, Match 16, 1994.

376. Details on the licensing procedure are in Section 7 of the Tuna Management Plan, Resolución Ministerial, N°110-94-PE, March 16, 1994.

377. Section 6.1. Resolución Ministerial, N°110-94-PE, March 16, 1994.

378. Section 6.2. Resolución Ministerial, N°110-94-PE, March 16, 1994.

379. "Peru's Prime Minister runs fishing!," *Fishing News International*, May 1996, p. 2 and INFOFISH, "Peru: New minister; new measures," *Trade News*, May 16, 1996.

380. Collao, *op. cit.*, August 4, 1997.

381. Gladys Liliana Rocha Freyre, Directora Nacional de Extracción, Ministerio de Pesquería, personal communications, Oficio N°277-96-PE/DNE-Dop, February 7, 1996.

382. Campos, *op. cit.*, May 28, 1997.

383. Collao, *op. cit.*, July 22, 1997.

384. See for example, Alejandro Bermejo, "Ismael Benavides y los palangreros japoneses," *Pesca*, September-October 1988, pp. 12-13.

385. Alejandro Bermejo, "En el atún, gobierno y transnacionales japonesas son 'imperialistas'," *Pesca*, July-August 1988, pp. 12-13.

386. Juan Neyra Balta, "Atún y el desarrollo del Peru," *Pesca*, January-February, 1995, pp. 11-12.

387. Collao, *op. cit.*, July 22, 1997.

SECTION XIV. (RESEARCH)

388. *Resolución Supremo 010-94-PE, March 24, 1994.*

389. Zuzunaga Zuzunaga, *op. cit.*, August 14, 1997.

390. Zuzunaga Zuzunaga, *op. cit.*, August 14, 1997.

391. See, for example, Landa C., "Datos sobre ...," *op. cit.* and Norma Chirichigno F., "Nuevas especies de peces de los generos *Mustelus* (Fam. *Triakidae*), *Raja* (Fam. *Rajisae*) y *Schedophilus* (Fam. *Centroolophidae*)," *Informe*, N°42 (IMARPE: Callao, June 1973), 40p.

392. Enrique Sánchez V., Eulalio Carrillo F., and Jaime Cisneros S., "Pesca experimental con palangre o long-line a bordo de una lancha anchovetera," *Informe*, N°69 (IMARPE: Callao, 1979) and Jaime Cisneros and Enrique Sánchez, "Pesca de atún con palangre en costa norte del Perú," *Rev. Com. Perm. Pacífico Sur*, vol. 11, 1980, pp. 473-480.

393. Section 5 of the Tuna Management Plan, Resolución Ministerial, N°110-94-PE, Match 16, 1994.

394. Ameya, *op. cit.*, August 14, 1997.

395. See for example Wong *et.al.*, "Utilización del tollo-tiburón ...," *op. cit.*

396. Sergio Balarezo Saldaña, Project Coordinator, IDB-UDEP Project, personal communications, July 7, 1997.

397. "A different school of fish," *Seafood Leader*, November-December 1994, p. 22 and Robert Coutu, President, Ocean Fresh Seafood, personal communications, July 11, 1996.

398. "MIF approves $3 million to modernize fisheries training in Peru," *Inter-American Development Bank New Release* (NR-073/96), March 21, 1996.

399. Jaime Espinoza Soriano, "Tiburones de la costa peruana," *Documenta*, N°66, October-December 1978, pp. 36-44.

400. Neyra Balta, "Pesquera atunera ...," *op. cit.*, p. 25.

401. RS 010-94-PE, March 24, 1994.

402. Ameya, *op. cit.*, August 14, 1997.

SECTION XV. (BY-CATCH)

403. Section 6.1. Resolución Ministerial, N°110-94-PE, March 16, 1994.

404. Section 6.2. Resolución Ministerial, N°110-94-PE, March 16, 1994.

405. For details on Peruvian sharks see Espinoza Soriano, "Tiburones ...," *op. cit.*

406. Salas, *op. cit.*, August 26, 1997.

407. Ameya, *op. cit.*, August 14, 1997.

408. Peruvian press reports have fluctuations in shark abundance as a result of climatic shifts, especially off the northern coast. "Como tollos venden a fieros tiburones," *La Republica*, December 22, 1982.

409. Comparative information on Japanese and other Asian (Korea and Taiwan) in the western Pacific suggest relatively low shark by-catches in tuna/swordfish longline operations. Japanese shark by-catches in tropical and subtropical areas of the Western Pacific were 0.5-2.5 percent, although over 30 percent was reported in temperate areas. Relatively high shark by-catches of 13 percent were reported by Taiwan in the Western Tropical Pacific. Kevin Bailey, Peter G. Williams, and David Itano, "By-catch and discards in Western Pacific tuna fisheries: A review of SPC data holdings and literature," *Technical Report*, No. 34 (Oceanic Fisheries Program: Noumea, New Caledonia, 1996), p. 4.26. For details on discard practices see table 4.7 in the same publication.

410. "Por precios altos se pone de moda filete de pez raya en los mercados de Lima," *El Comercio*, July 3, 1989, p. 1.

411. Farrington, *Fishing the Pacific*, *op. cit.*, p. 75.

412. Carocci and Majkowski, *Pacific Tunas and Billfishes, op. cit.*, map 10.

413. Ameya, *op. cit.*, August 14, 1997.

414. Pastor, *op. cit.*, June 6, 1997.

415. Ameya, *op. cit.*, August 14, 1997.

416. This is somewhat higher than the Japanese report in the Western Pacific. Bailey, *et. al.*, "By-catch and discards ...," *op. cit.*, p. 4.26.

417. See for example Pamela T. Plotkin, Richard A. Byles, and David W. Owens, "Migratory and reproductive behavior of *Lepidochelys olivacea* in the eastern Pacific Ocean," in Barbara A. Schroeder and Blair E. Witherington, compilers, "Proceedings of the Thirteenth Annual Symposium on sea turtle biology and conservation," *NOAA Technical Memorandum*, NMFS-SEFSC-341 (NMFS-SEFSC: Miami, January 1994), p. 138; Scott Eckert, Hubbs-Sea World Research Institute, personal communications, September 26, 1997; and Peter Dutton, Specialist on the molecular ecology of turtles, Comments at the United States-Mexico Fishery Cooperation Talks, Huatulco, Mexico, September 4, 1997.

418. The MIPE Resolución was issued in 1976.

419. Carlos F. Aranda A., "Marine turtles in Peru," *Marine Turtle Newsletter*, April 1989.

420. Hans Louis Schmidt, General Manager, Pesquera Omega, personal communications, April 8, 1996.

421. Bailey, *et. al.*, "By-catch and discards ...," *op. cit.*, table 4.29.

422. "Turtle skins seized," *Fishing News International*, May 1985.

423. Robert A. Dollar, "Annual report of the 1993 Western Pacific longline fishery," *Southwest Fisheries Center Administrative Report* H-94-06, August, 1994, pp. 9, 24-25.

424. Rene Marquez, Mexican National Turtle Coordinator, comments at Mexican-United States Fishery Cooperation Talks, September 4, 1997, Huatulco, Mexico.

425. While the satellite tracking devices were attached to only a few turtles, the preliminary results are striking. All of the tagged turtles moved south and then southeast toward the Galápagos. The tract was probably deflected somewhat westward by prevailing currents. From the Galápagos the turtles appear to be moving on to Chile and Peru. When more data is available they may show foraging movements in Chilean coastal waters. The strong El Niño developing in 1997 may affect the migratory pattern so 1997 may not prove to represent normal movements. Scott Eckert, Hubbs-Sea World Research Institute, personal communications, September 25, 1997 and Scott Eckert. The satellite data prepared by Eckert for this study is reproduced as figure 30.

426. Some Peruvian writers refer to both species as sea lions ("lobos marinos"): "comun" or "chusco" (sea lion) and "fino" (fur seal).

427. Karen De Young, "Peruvian conservationists mounts attack on seal killers," *Washington Post*, April 3, 1978, p. A14.

428. Humberto Tovar Serpa and Humberto Fuentes Tapia, "Magnitud poblacional de lobos marinos en el litoral peruano en marzo de 1984," *Informe*, N°88 (IMARPE: Callao, 1984), p. 12.

429. New Zealand observers, for example, report that Japanese longliners targeting bluefin tuna were taking seals. Bailey, *et. al.*, "Bycatch and discards ...," *op. cit.*, p. 4.12.

430. Based on information compiled by Ricardo Ghersi Belúnde, Universidad Villareal. "Lobos marinos no depredan el mar," *Informativo del MIPE*, April-June 1981.

431. Jorge Mehía Gallegos, "La pesca aretesanal y los lobos marinos," *Pesca*, July-August, 1989, pp. 8-10. One recent press report noted complaints in 1995 by artisanal fishermen at Matarani. INFOFISH, "Artisanal fishermen against industrial fishing, *Trade News*, December 1, 1995.

432. Bailey *et. al.*, "By catch and discards ...," *op. cit.*, table 4.7.

433. Dollar, "Annual report ...," pp. 24-25.

434. Tovar Serpa and Fuentes Tapia, "Magnitud poblacional...," *op. cit.*

435. "Plea for sea lion cull in Peru," *Seafood International*, April 1997, p. 11.

436. Bailey, *et. al.*, "Bycatch and discards ...," *op. cit.*, p. 4.12.

437. See the individual country chapters on Brazil, Chile, and Uruguay.

438. The authors have no information on Peru, but some useful background information is available on the western Pacific. Bailey, *et. al.* "Bycatch and discards ...," *op. cit.*, p. 4.12.

439. Dollar, "Annual report ...," pp. 24-25.

440. For details see Weidner and Hall, "Latin America," *op. cit.*

441. One expert on Soviet fisheries suspects it was probably the coastal demersal trawl fishery for hake. Kaczynski, *op. cit.*, July 9, 1997.

SECTION XVI. (INTERNATIONAL)

442. The Government allowed the Soviets and Cubans to operate out of Peruvian ports, but usually restricted their operations to grounds outside the 200-mile limit. In a few years, however, operations within the 200-mile zone were permitted. For details see Weidner and Hall, "Latin America," *op. cit.*

443. Echeandía Zegarra, *op. cit.*, June 3, 1997.

444. Campos, *op. cit.*, January 25, 1996.

445. A Japanese longliner with a 300 t hold could catch about 600 t annually. If about 4 percent of the catch is billfish (appendix B5a), at least 2 percent would be swordfish. That would mean it would take about 60 longliners to catch the 690 t reported in 1993 (appendix C2b).

446. Chilean fishermen reported a catch of over 7,000 t in 1991, but officials are concerned about catches which have since declined.

447. See the Ecuadorean chapter of this report for details.

448. For details see the Ecuadorean chapter of this report.

449. For details on Japanese commercial activities in Peru see "Joint Ventures" in this report and the Japanese chapter in Wildman, "Asia" *op. cit.*

450. A good description of the licensing arrangements with the Japanese longliners is available in Bermejo, "Ismael Benavides ...," *op. cit.*

451. "Submarine, Japanese boat collide; three dead," Kyodo (Tokyo), 1020 GMT, August 27, 1988.

452. Uozumi, *op. cit.*, February 6, 1997.

453. "El Instituto Peruano de Derecho Pesquero dice 'No'," *Pesca*, July-August 1988, pp. 10-11.

454. "Japanese fishing boat detained in Callao on $53 mn submarine claim," *The Andean Report*, May 1989, p. 138.

455. Juan Neyra Balta, "Pesqueria atunera: anhelo y desafío," *Pesca*, July-August 1995, p. 25 and Campos, *op. cit.*, January 25, 1996.

456. National Fisheries Research and Development Agency (NFRDA), "Fishery statistics and fishing grounds for the Korean tuna longline fishery, 1988-1992" *Technical Report of the NFRDA*, (NFRDA: Seoul, December 1993), pp. 87, 157, 227, 297, and 367. For overall details on the Korean swordfish fishery, see the Korean chapter of this report. Wildman, "Asia," *op. cit.*

457. Alejandro Covarrubias, Director de Fiscalización, SERNAP, personal communications, August 17, 1995.

458. The vessels deployed are large longliners which freeze their catch. Trips are reportedly 3-4 months, but it is unclear if this refers to Pacific as well as Atlantic operations. Subdirección General de Recursos Internos Comunitarios, Dirección General de Recursos Pesqueros, Ministerio de Agricultura, Pesca y Alimentación, "Pesquera Española del pez espada," undated report, probably released in 1994.

459. Schmidt, *op. cit.*, April 8, 1996 and Salas, *op. cit.*, August 26, 1997.

460. Echeandía Zegarra, *op. cit.*, July 22, 1996 and unpublished Chilean Navy data (Chile, appendix D4).

461. Echeandía Zegarra, *op. cit.*, July 19, 1996.

462. I. Fernández, *op. cit.*, July 2, 1996.

463. Garcia, *op. cit.*, June 27, 1996. Details on the various Spanish companies are available in the Spanish chapter of this study, Folsom, "Western Europe," *op. cit.*

464. Zuzunaga Zuzunaga, *op. cit.*, February 26, 1996.

465. See the Chilean chapter of this report for details.

466. Iñaki Fernández, Assistant Manager, Maicoa Fisheries, Vigo, Spain, personal communications, July 2, 1996.

467. Echeandía Zegarra, *op. cit.*, June 26, 1996.

468. Gallo, *op. cit.*, June 18, 1996.

469. Mike Justen, NMFS-F/SWR, personal communications, October 19, 1995.

470. I. Fernández, *op. cit.*, July 2, 1996.

471. Some information is available on the size of swordfish being taken by Chilean longline fishermen off northern Chile which could provide insight into Spanish activity in the same general area. For details see the Chilean chapter of this report.

472. TRC, *Annual Catch Statistics ...*, *op. cit.*, pp. F1-4 and F21-25. For further details see the Central American chapters of this report.

473. See the U.S. chapter of this report for details.

474. John Childers and Forrest R. Miller, "Summary of the 1994 U.S. north and south Pacific albacore troll fisheries," *Southwest Fisheries Science Center Administrative Report*, LJ-95-15, July 1995, 57p.

475. One U.S. fisherman operated the *Mandy J* and *Sundance* off Chile. He reportedly would have preferred to have transshipped through Chilean ports because of the more stable political climate, absence of terrorism, and superior port and supply facilities as well as being closer to the fishing grounds. The owner reported that transshipment costs are substantially higher through Callao. U.S. Embassy reports indicate that he was using the Peruvian port of Callao. U.S. Embassy, Santiago, "Sundance returns," message number 4017, May 22, 1992; U.S. Embassy, Santiago, "USA, Sundance update," message number 5140, July 2, 1992 and U.S. Embassy, Santiago, "Sundance update," message number 5601, July 17, 1992.

476. Soviet catches off West Africa have been as high as 1,400 t (1974), but this was an anomaly. Catches did not exceed 300 t in any other year.

477. For details on the Soviet mid-water trawl fishery off Chile and Peru see Weidner and Hall, "Latin America," *op. cit.*

478. One expert on Soviet fishing believes it was probably taken in the coastal demersal trawl fishery for hake. Kaczynski, *op. cit.*, July 9, 1997.

479. Weidner, "Peruvian tuna fishery," *op. cit.*

480. See for example, Hinton and Deriso, "Structure and assessment ...," *op. cit.*

481. "Keep foreign fleets out--to preserve stocks," *Fishing News International*, September 1996.

482. Weidner and Hall, "Latin America," *op. cit.*

483. Cultecmar adds that their small trawlers would employ Peruvian crews and supply the Peruvian market. James McDonald Checa, "Pesca para consumo humano directo," *El Comercio*, July 7, 1993, p. 2.

484. Bermejo, "Ismael Benavides y los palangreros japoneses," *op. cit.*

485. INFOPESCA, "Atun enfriado ...," *op. cit.*

486. Swordfish sells for only about half the price of tuna. Uozumi, *op. cit.*, February 6, 1997.

487. Alfonso Arevalo and Oswaldo Hundskopf, "El Instituto Peruano de derecho pesquero dice 'No'," *Pesca*, July-August, 1988 pp. 10-11.

488. Federation of Japan Tuna Fisheries Co-operative Associations (Nikkatsuren), *Japan Tuna* (Nikkatsuren: Tokyo, 1995), pp. 21-22. Nikkatsuren uses the term "Japan Tuna" as a shortened English title for the Association.

489. For details on the Spanish companies, see the Spanish chapter in Folsom, "Europe," *op. cit.*

490. Smith, "La industria Peruana ...," *op. cit.*

491. "Japan-Peru sashimi enterprise," *INFOFISH Trade News*, June 16, 1995.

492. "Soviet loan to aid construction of fishing terminal," Lima PRELA, 2005 GMT, February 12, 1979.

493. For details, see the discussion in Jacobson and Weidner, "Soviet-Latin American ...," *op. cit.*

494. Weidner and Hall, "Latin America," *op. cit.*

495. "¿FAO, honesto intermediario?" *Pesca*, October, 1974, p. 5.

496. See for example, "Expertos FAO asesorarán plan pesquero perunao," *Peruano*, January 31, 1986.

497. "Loan will mean more fish for food," *Fishing News International*, February 1979.

498. Roger Hamilton, Editor of *The IDB*, personal communications, May 8, 1996.

499. Balarezo Saldaña, *op. cit.*, July 7, 1997.

500. "MIF approves $3 million to modernize fisheries training in Peru," *Inter-American Development Bank New Release* (NR-073/96), March 21, 1996, and "Fujimori, IDB sign $5.9 million to assist small business, fisheries," *Inter-American Development Bank New Release* (NR-131/95), May 22, 1966. The UNP was considered for executing parts of the project, but because of various operational problems has not been deeply involved.

501. Balarezo Saldaña, *op. cit.*, July 7, 1997.

SECTION XVII. (ENFORCEMENT)

502. For details see the Peruvian chapter of Weidner and Hall, "Latin America," *op. cit.*

503. Campos, *op. cit.*, May 28, 1997.

504. If 200 foreign longliners were operating off Peru, it is likely that some would enter the country's 200-mile zone and that occasional seizures would result.

505. Effort in the southeastern Pacific appears to vary considerably. The main target species is bigeye and Japanese catches have varied from 17,700 in 1990 to only 5,700 t in 1995. FAO, *Yearbook of Fishery Statistics*, 1995. Thus the number of longliners appears to have also varied widely from year to year.

506. See for example: "Patrol captures two Peruvian boats," Paris AFP, 1602 GMT, September 8, 1979; "Peruvian fishing vessels captured, unloaded," Paris, AFP, 2056 GMT, July 13, 1984; "!6 goletas peruanas sorprendidas en aguas chilenas!," *La Tercera de la Hora*, July 14, 1984; "Otros tres pesqueros peruanos retenidos," *El Mercurio*, August 2, 1984; "Two Peruvian boats captured off Arica," Santiago Domestic Service, 2140 GMT, September 6, 1984; "Peru releases 2 Chilean fishing boats," *El Mercurio*, March 9, 1989, p. C7; "Chilean fishing boat seized, held port of Ilo," Lima, Television Peruana, 1100 GMT, June 6, 1989; and Minister Rojas says Peruvian boat incident over," Santiago, Television Nacional de Chile Network, 1800 GMT, April 23, 1990.

507. "Peruvian boat reportedly attacks fishing vessel," Noticias Argentinas (Buenos Aires), 1931 GMT, April 22, 1990.

508. See for example: "Ecuadorean fishing boats pay fines, released," Paris AFP, 1915 GMT, November 28, 1983; "Navy notes detainment of Ecuadorean ships," Paris AFP, 1301 GMT, December 30, 1986; U.S. Embassy, Quito, "Ecuadorean economic developments," message number 826, January 21, 1987; "Detienen a pesquero ecuatoriano," *Expreso*, November 8, 1987; "Perú liberó a buques pesqueros," *Expreso*, November 29, 1988; "Pesqueros de Ecuador en mar peruano," *El Comercio*, February 11, 1989; "Navy seizes 2 Ecuadorean fishing vessels," Madrid EFE, 0116 GMT, February 12, 1989; "Juzgan a 8 pesqueros peruanos en Ecuador," *Diario las Americas*, April 18, 1990; and "Peruvian boat reportedly attacks fishing vessel," Buenos Aires, Noticias Argentinas, 1931 GMT, April 22, 1990.

509. U.S. Consulate General, Guayaquil, "Tuna boat seizures," message number 2455, November 20, 1979 and U.S. Department of State, "Tuna situation off Ecuador and Peru," message number 354205, December 14, 1983.

510. "Fisherman reportedly killed by Ecuadoreans," Paris AFP, 1944 GMT, December 17, 1983; "Navy Minister on attack against fishing vessels," Paris AFP, 2043 GMT, December 20, 1983; and "Peruvian boat reportedly attacks fishing vessel," *op. cit.*

511. "Navy denies ship deployment offshore from Guayaquil," Madrid EFE, 2035 GMT, February 3, 1995.

512. Echeandía Zegarra, *op. cit.*, July 19, 1996.

513. "Submarine, Japanese boat collide; three dead," Kyodo (Tokyo), 1020 GMT, August 27, 1988 and "Rescatan submarino '*Pacocha*' tras once meses de hundimiento," *El Comercio*, July 25, 1989, p. 1. The submarine was subsequently raised. Pascual Huaylinos, "Le soplaron aire y ... !Bluuuumm!, *Oiga*, July 31, 1989, pp. 30-33.

514. "Embargo de barco japonés está al voto en tribunal de Callao," *El Comercio*, July 8, 1989.

515. "Multan a barco mexicano por pescar en aguas de Perú," *Diario las Americas*, December 3, 1983, and U.S. Department of State, "Tuna situation ...," *op. cit.*

516. U.S. Embassy, Lima, e-mail message, February 2, 1995.

APPENDICES

Series A: Fleet
Series B: Catch
Series C: Processing
Series D: Agencies/Companies
Series E: Trade
- E1: Overall
- E2: EU
- E3: Japan
- E4: United States

Series F: Contracts
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Series H: Glossary

Appendix A1.--Peru. Fishing fleet, 1994

Fishery	Vessels	Capacity	
		Total	Vessel*
	Number	Tonnage	
Purse seine			
Reduction	518	118,660	229
Edible	83	12,902	155
Trawlers	42	7,652	182
Tuna fleet	3	272	91
Small-scale	5,362	16,426	3
Total	6,008	155,912	NM

* Average per vessel
NM - Not meaningful
Source: Ministry of Fisheries as cited by the U.S. Embassy, Lima, "Peru: Fishing industry report, 1994," December 1944, p. 4.

Appendix A2.--Peru. Commercial longliners, 1980-97

Vessel	Size	Size		Owner/ chandler	Acquired/leased chandler	Hold	Built	
		Vessel	Hold				Country	Year
	Meters	GRT	Tons					
Peruvian owned								
Andrew	23		48♦♦	Pesquera Atlantis	1995	RSW	Japan	
Audaz	18			Sindicato Pesquero				
Audaz 1	20			Sindicato Pesquero	1997	Ice hold	Peru	1997
Christopher	23		42♦♦	Pesquera Atlantis	1995	RSW	Japan	
Eraz I	14	20	8	Echeandia@@	1996	Ice hold	Peru	1996
Ibaraki@	50	150	192♦♦	University of Piura	1994	Freezer	Japan	
Inca Mar#		299	134	Tuna Latin***	1980-96	Freezer	Japan	1970
Juliana	6			Peter Sucksmith	1994@@@	NA		
Maria José♦	25		59	Consorcio Pesquero	1993-96	Freezer		
Maria José	25		59	Cazamar	1997	Freezer		
Paloma*			90	Consorcio Pesquero	1995-96	Freezer		
Peña Cayetano	17			NA		NA		
Pionero	18			Sindicato Pesquero				
Pionero 1	20			Sindicato Pesquero	1997	Ice hold	Peru	1997
Rossie	23		66♦♦	Pesquera Atlantis	1995	RSW	Japan	
SIPESCA	18	80		NA				
Triunfador	20			Sindicato Pesquero	1997	Ice hold	Peru	1997
Unknown****								
Foreign leased vessels								
Jyutoku Maru 6				Tuna Latin	1992	Freezer		
Kiku Mary 26				Tuna Latin	1992	Freezer		
Koei Maru 18				Tuna Latin	1992	Freezer		
Senko Maru 1				Tuna Latin	1992	Freezer		
Senko Maru 26				Tuna Latin	1992	Freezer		
Senko Maru 38				Tuna Latin	1992	Freezer		
Senko Maru 51				Tuna Latin	1992	Freezer		
Taisei Maru I	48		NA**	***	1994E??	Freezer		
Tokujo Maru#		300	134	Tuna Latin	1980	Freezer		
Unknown##								
Unlicensed vessels operating from Peruvian ports								
Japanese								
Unknown								
Spanish								
Arosa Primera				Palangeros del Atl.	19??-96			
Alicante		170			19??-96			
Carvisa					1996			
Depredador					1996			
Espadarte					1997			
Juanitoba I					1996-97			
Maicoa	36	500###185		Pesquera Maicoa	1993-97	Freezer	Spain	1988
Maicoa I		524		Pesquera Maicoa	1993-96	Freezer	Spain	1994
Radoche I					1997			
Rosu III					1997			
Urugora				Pesquera Maicoa	1993-96	Freezer		

E - Estimated
NA - Not available
RSW - Refrigerated seawater
@ Research vessel donated by the Japanese Government.
@@ Sr. Echeandia is the General Manager of TRAMARSA. He is purchasing the *Eraz I* separately as part of a group of investors.
@@@ Owner is a U.K. national. The vessel was reported adrift on March 15, 1994, by a Spanish freighter.
# The *Inca Mar* was formerly the leased Japanese vessel *Tokujo Maru*. Since 1985 it has not been operated as a longliner, but rather used as a floting cold store.
Tuna Latin alone reported leasing six Japanese longliners in the early 1980s.
ONI reports 400 GRT.
* Registered in Panama and fishing outside of the 200-mile zone. Sold to a foreign company in 1997.
** 208 NRT
*** One unconfirmed report indicated that Tuna Latin deployed three longliners in 1995, but no current information is available.
**** Several small artisanal longliners and small commercial longliners landing fresh product reportedly operate under contract to companies in Paita (such as Agro-Pesca). Few details are currently available.
♦ Panamamian-flagged vessel
♦♦ Cubic meters
Source: Various

Appendix A3.--Peru. Characteristics of Japanese vessels operating from Peruvian ports

Vessel	Port	Year*	Size	Crew		
				Japan	Peru	Total
			GRT			
Kyowa Maru 8	Callao	1988	412	16	5	21

* Dates when the vessel was known to be operating, but actual operations could cover other years.
Source: "Submarine, Japanese boat collide; three dead," Kyodo (Tokyo), 1020 GMT, August 27, 1988.

Appendix A4.--South America. Characteristics of Spanish longliners operating off South America, 1996

Vessel*	Built/ Refurbished	Size			Freezer#	Longline		Crew
		Length	Tonnage	Hold		Length	Hooks	
		Meters	GRT	Tons	Celsius	Kilometers	Number	Persons
Alicante	1966/1988	NA	170	NA	-30°	8	800	20-23
Arosa Primera		36	300	120	-28°	10	500	15-17
Maicoa		36	500	185	-35°	65	4,000	18-20
Maicoa I								
Urugora								
Virgen de la Franqueira	1966	NA	180	NA	-30°	8	800	20-24

\# Minimum temperture
Source: Interviews with company officials

Appendix A5.--South America. New large commercial fishing vessels,* 1996-97

Country	Vessel			Owner	Built		Scheduled
	Type	Size	Length		Country	Shipyard	
		Tons**	Meters				
Argentina							
	Longliner#	NA##	44	Birting	Norway	Westcon	1996
	Longliner#	NA##	44	Birting	Norway	Westcon	1996
	Longliner#	NA	50	NA	Norway	Westcon	1996
	Trawler	NA	29	NA	Argentina	Federico Contessi	1996
Chile							
	Seiner	1,500	65	Pesquera Chilesur	Chile	Asmar	1996
	Seiner	1,600	66	Pesquera San José	Chile	Asmar	1996
	Seiner	NA	47	Pesquera Coloso	Chile	Marco Chileana	1996
	Comb.***	NA	75	Pesquera DOF	Chile	Asenav****	1997
	General	1,000	NA	NA	Chile	Marco Chileana	1996
Peru							
	Seiner	590	46	Copetsa	Peru	Andesa	1996
	Seiner	540	45	Trujillo	Peru	Andesa	1996
	Seiner	850	51	Sindicato Pesquero	Chile	Asenav	1996
	Seiner	300	NA	Austral	Peru	Remesa	1996
	Seiner	350	NA	Mata V	Peru	Remesa	1996
	Seiner	300	NA	Pes. San Antonio	Peru	Remesa	1996
	Seiner	550	43	Rodga	Peru	Navinsa	1996
	Seiner	370	38	Pes. Monteverde	Peru	Navinsa	1996
	Seiner	580	44	Pes. Carolina	Peru	Navinsa	1996
	Seiner	340	35	Procesadora El Carmen	Peru	Navinsa	1996
	Seiner	580	NA	Pes. Velevit	Peru	SIMA	1996

* Vessels with capacaities of 300 tons are larger.
** Capacity
*** Combination: Purse seiner/mid-water trawler
**** Norwegian designers (Vik & Sandvik Skipstekniskhe Konsulenter
\# These vessels will be deployed for demersal longlining targeting toothfish and other species off southern Argentina. The Norwegian shipyard Brattvaag Skipsverft delivered other longliners to a U.S.-Argentine joint venture during 1995, also deployed in demersal operations.
962 GRT.
Note: The above list is not complete, but includes most of the larger vessels added to Latin American fishing fleets during 1996.
Source: "Vessel orders and deliveries," *World Fishing Vessel Yearbook*, 1996, pp.53-61; "Fishing vessels on order for delivery during 1996/97," *World Fishing*, June 1996, pp. 32-35; and other sources.

Appendix B1.--Peru. Fisheries catch, 1938-96

Year	Catch	Year	Catch
Million Metric tons		Million Metric tons	
1938	Negl		
1939	NA	1980	2.7
1940#	NA	1981	2.7
		1982#	3.5
1947*•	NA	1983#	1.6
1948*	0.1	1984	3.8
1949*	0.1		
		1985	4.1
1950*#	0.1	1986#	5.6
1951*#	0.1	1987#	4.6
1952*	0.2	1988	6.6
1953*	0.2	1989	6.9
1954*	0.2		
		1990	6.9
1955	0.2	1991#	6.9
1956*	0.3	1992#	6.9
1957*	0.5	1993#	8.5
1958	1.0	1994	11.6
1959	2.2		
		1995#	8.9
1960	3.6	1996	9.6E
1961	5.3	1997#	NA**
1962	7.0		
1963	6.9		
1964*	9.1		
1965	7.5		
1966	8.8		
1967*	10.2		
1968*	10.6		
1969*	9.2		
1970*	12.5		
1971	10.5		
1972#	4.7		
1973*#	2.3		
1974	4.1		
1975	3.4		
1976	4.3		
1977#	2.5		
1978#	3.5		
1979	3.7		

E - Estimate

* Years in which swordfish catches exceeded 500 t (appendix B2a).

** The Peruvian catch will decline in 1997, in part because the southern anchovy stock has shifted south into Chilean waters. In other areas the anchovy catchg may be abnormally high because the El Niño often conentrates the fish in easily fished coastal areas. Unless carefully contrled, heavy fishing can exacerbate the impact of the El Niño event on stocks. If the 1997 El Niño proves as severe as anticipated, almost certainly a major decline will be experienced in 1998

El Niño years. These events were of varying intensity. The El Niño events noted in the early 1990s were unusual, consisting of only modest warming extended over an usual time period. Climatologists have not reached a consensus on how to characterize it.

Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix B2a.--Peru. Swordfish catch, 1948-96

Year	Catch			Year	Catch	
	Smith	FAO	IMARPE**		FAO	IMARPE**
	Metric tons				Metric tons	
1940	60*					
1941***				1970	2,400	2,396
1942***				1971	200	185
1943***				1972	NA	550
				1973	1,900	1,941
1945***				1974	470	470
1946						
1947		1,100		1975	158	158##
1948	423#	2,600		1976	294	264##
1949	1,385#	2,100		1977	420	420##
				1978	436	436##
1950	2,585#	6,900		1979	188	188##
1951	1,170#	2,400				
1952		1,900		1980	216	
1953		900		1981	91	
1954		700		1982	154	
				1983	225	238
1955		400		1984	298	343
1956		600				
1957		600		1985	92	55
1958		400		1986	33	21
1959		400		1987	62	73
				1988	129	54
1960		400		1989	83	3
1961		300				
1962		400		1990	2	1
1963		200		1991	3	3
1964		900		1992	21	16
				1993	19	21-76•
1965		300	287	1994	5	7-310•
1966		200	193			
1967		1,300	1,274	1995	-	7
1968		800	778	1996	NA	NA
1969		1,200	1,162			

E - estimated
NA - Not available
* Landings in southern ports. Smaller quantities were also landed at several other ports.
** Includes Peruvian catches and small incidental catch of the Japanese longliners operating off Peru. Ministry of Fisheries data used in some years.
*** No data is available for the war years (1941-45), but unconfirmed reports indicate that swordfish was shipped to the United States during this period.
# Export data. Only small quantities were marketed domestically, mostly damaged fish that were not export grade. Actual catches were greater as the export shipments were product weight, about 65 percent of liveweight. The 1950 shipments would have had a live weight equivalent of about 3,300 tons.
Ministry of Fisheries data.
• The smaller quantity was landed by the domestic fishermen. The larger number includes factory vessel bycatch (55 t in 193) and landings from associated foreign vessels (303 t in 1994). See appendix B3d2).
Sources: Robert O. Smith, "La industria Peruana de congelacion de pez espada y atun," *Pesca y Caza*, Nº2, 1951 (1940-51 data); FAO, *Yearbook of Fishery Statistics*, various issues (1955-93 data); IMARPE, *Informe*, Nº30 and 32 (IMARPE: Callao, different dates) (1968-69 data); Oficina Sectorial de Pesqueria, Ministerio de Pesqueria, *Anuario Estadistico Pesquero*, various years (1974-78 data); M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 63-202 (1983-92 data); Manuel J Flores, Segundo Vera, Raúl Marcelo, and Erika Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana durante 1995," *Informe Progresivo*, Nº45, November, 1996, p. 18; and unpublished statistics (1993-94 data) and Dra. Emira Antonieti, Director of Research, IMARPE, personal communications, June 20, 1996, and March 13, 1997 (1994-95 data).

Appendix B2b.--Peru. Swordfish landings by product form, 1965-86 data

Year	Form			Total*
	Fresh	Frozen	Cured	
	Metric tons			
1965	-	287	-	287
1966	Negl	193	-	193
1967	102	1,171	-	1,274
1968	580	199	-	778
1969	200	962	-	1,162
1970	378	2,018	-	2,396
1971	117	58	10	185
1972	252	71	228	550
1973	991	710	240	1,941
1974	269	1	201	470
1975	153	5	-	158
1976	239	25	-	264
1977	365	55	-	420
1978	339	97	-	436
1979	168	20	-	188
1980				
1981	75	15	-	91
1982				
1983				
1984				
1985				
1986	33	Negl	-	33
1987				
1988				
1989				

* Totals may not agree due to rounding.
Source: Ministerio de Pesqueria, Oficina Sectorial de Planificación, *Anuario Estadístico Pesquero,* (Lima: Ministerio de Pesqueria, various years) (1965-79 data); Ministerio de Pesqueria, Oficina Sectorial de Planificación, *Informe Estadístico Anual del Sector Pesquero, 1981* (Lima: Ministerio de Pesqueria, 1982) (1981 data); and Ministerio de Pesqueria, Oficina de Presupuesto y Planificación, *Parte de Actividades del Sector Pesquero, 1986* (Lima: Ministerio de Pesqueria, June 1987) (1986 data).

Appendix B3a1.--Peru. Swordfish catch by port, alphabetical order, 1968-69

Port	Year	
	1968	1969
	Metric tons	
Acapulco		
Cabo Blanco	19	
Callao-TPZ		
Chimbote		
Caleta Cruz	147*	
Ilo		
Lobitos	4	
Máncora	135	
Matarani		
(El) Ñuro		
Paita	53*	
Punta Cancas		
Punta Mero		
Puerto Pizarro		
Talara	394	
Vila Vila		
Zorritos	28	
Others		
Total**	778	

* The swordfish landed at these ports was mostly processed commercially and exported.
** Totals may not agree due to rounding.
Source: IMARPE, *Informe*, Nº30 and 32 (IMARPE: Callao, different dates) (1968-69 data)

Appendix B3a2.--Peru. Swordfish catch by port, alphabetical order, 1968-69

Port	Year	
	1968	1969
	Metric tons	
Northern coast		
Puerto Pizarro	-	
Caleta Cruz	147*	
Zorritos	28	
Punta Mero	-	
Punta Cancas	-	
Máncora	135	
(El) Ñuro	-	
Cabo Blanco	19	
Lobitos	4	
Talara	394	
Paita#	53*	
Subtotal	778	
Central coast		
Chimbote	-	
Callao-TPZ	-	
Southern coast		
Ilo	-	
Unknown		
Acapulco	-	
Matarani	-	
Vila Vila	-	
Total**	778	

* The swordfish landed at these ports was mostly processed commercially and exported.
# Paita is located at approximately 5°N, the other ports are north of Paita.
** Totals may not agree due to rounding.
Source: IMARPE, *Informe*, Nº30 and 32 (IMARPE: Callao, different dates) (1968-69 data).

Appendix B3b1.--Peru. Swordfish catch by port, alphabetic order, 1975-79

Port	Year				
	1975	1976	1977	1978	1979
			Metric tons		
Acapulco	-	NA	-	-	-
Cabo Blanco	Negl	NA	25	21	16
Caleta Cruz	10	NA	37**	77**	3**
Callao-TPZ	-	NA	-	Negl	-
Cancas	-	NA	7**	-	-
Chimbote	1	NA	4	-	-
Ilo	-	NA	-	-	-
Lobítos	-	NA	3	17	5
Máncora	86	NA	204	182	63
Matarani	-	NA	-	-	-
Negritos	-	NA	-	2	1
(El) Ñuro	-	NA	-	-	-
(Los) Organos	-	NA	-	1**	-
Paita	-	NA	29	-	-
Pisco	Negl	NA	-	7**	-
Pucusana	-	NA	-		1
Punta Cancas	-	NA	-	-	-
Punta Mero	-	NA	-		3
Puerto Pizarro	NA	NA	9	4	1
Talara	1	NA	28	55	28
Vila Vila	-	NA	-	-	-
Zorritos	59	NA	74	69	67
Others	-	NA	-	1	-
Totals*					
Fresh	153	239	365	339	168
Frozen	5	25	55	97	20
Grand total*	158	264	420	436	188

* Totals may not agree due to rounding.
** Mostly frozen
*** Landed mostly fresh
Source: Ministerio de Pesqueria, Oficina Sectorial de Planificación, *Anuario Estadístico Pesquero, Peru-1979* (Lima: Ministerio de Pesquetia, 1980).

Appendix B3b2.--Peru. Swordfish catch by port, geographic orientation, 1975-79

Region/port	Year				
	1975	1976	1977	1978	1979
	Metric tons				
Northern coast					
Puerto Pizarro	NA	NA	9	4	1
Caleta Cruz	10	NA	37**	77**	3**
Zorritos	59	NA	74	69	67
Punta Mero	-	NA	-		3
Cancas	-	NA	7**	-	-
Máncora	86	NA	204	182	63
(Los) Organos	-	NA	-	1**	-
Cabo Blanco	Negl	NA	25	21	16
Lobítos	-	NA	3	17	5
Talara	1	NA	28	55	28
Negritos	-	NA	-	2	1
Paita#	-	NA	29	-	-
Subtotal, north	157	NA	416	429	187
Central coast					
Chimbote	1	NA	4	-	-
Callao-TPZ	-	NA	-	Negl	-
Pucusana	-	NA	-		1
Pisco	Negl	NA	-	7**	-
Subtotal, central	1	NA	4	7	1
Southern coast					
Ilo	-	NA	-	-	-
Others	-	NA	-	1	-
Totals*					
Fresh	153	239	365	339	168
Frozen	5	25	55	97	20
Grand total*	158	264	420	436	188

* Totals may not agree due to rounding.
** Mostly frozen
*** Landed mostly fresh
# Paita is located at approximately 5°N, the other ports are north of Paita.
Source: Ministerio de Pesqueria, Oficina Sectorial de Planificación, *Anuario Estadístico Pesquero, Peru-1979* (Lima: Ministerio de Pesqueria, 1980).

Appendix B3c1.--Peru. Swordfish catch by port, alphabetical order, 1983-89

Port	Year						
	1983	1984	1985	1986	1987	1988	1989
	Metric tons						
Acapulco	-	11	-	-	-	5	
Cabo Blanco	-	-	-	-	-	Negl	
Callao-TPZ	-	-	-	-	-	-	1
Chimbote	160	1	-	-	-	-	
Caleta Cruz	5	4	6	Negl	17	3	Negl
Ilo	-	-	-	-	-	-	
Máncora	-	1	-	5	1	2	1
Matarani	-	-	-	-	Negl	-	
(El) Ñuro	-	-	-	-	-	Negl	Negl
Paita	-	-	2	Negl	39	7	Negl
Punta Cancas	-	8	-	-	14	35	Negl
Punta Mero	-	-	-	-	-	Negl	
Talara	-	-	13	-	Negl	-	Negl
Vila Vila	-	-	-	Negl	-	-	
Zorritos	-	-	-	15	2	2	1
Others	-	-	Negl	1	Negl	-	
Other*	73	318	34	-	-	-	
Total	238	343	55	21	73	54	3

* Soviet factory trawler fleet

Source: M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 63-202 (1983-92 data) and Dra. Emira Antonieti, Director of Research, IMARPE, personal communications, June 20, 1996 (1993-94 data).

Appendix B3c2.--Peru. Swordfish catch by port, geographical order, 1983-89

Region/port	Year						
	1983	1984	1985	1986	1987	1988	1989
	Metric tons						
Northern coast							
Caleta Cruz	5	4	6	Negl	17	3	Negl
Zorritos	-	-	-	15	2	2	1
Acapulco	-	11	-	-	-	5	
Punta Mero	-	-	-	-	-	Negl	
(Punta) Cancas	-	8	-	-	14	35	Negl
Máncora	-	1	-	5	1	2	1
(El) Ñuro	-	-	-	-	-	Negl	Negl
Cabo Blanco	-	-	-	-	-	Negl	
Talara	-	-	13	-	Negl	-	Negl
Paita**	-	-	2	Negl	39	7	Negl
Subtotal, north	5	24	21	20	73	54	2
Central coast							
Chimbote	160***	1	-	-	-	-	
Callao-TPZ	-	-	-	-	-	-	1
Subtotal, central	160***	1	-	-	-	-	-
Southern coast							
Matarani	-	-	-	-	Negl	-	
Ilo	-	-	-	-	-	-	
Vila Vila	-	-	-	Negl	-	-	
Subtotal, south	-	-	-	Negl	Negl	-	
Other							
Other ports	-	-	Negl	1	Negl	-	
Factory vessels	73	318	34	-	-	-	
Subtotal, other	73	318	34	1	Negl	-	
Total	238	343	55	21	73	54	3

* Soviet factory trawler fleet
** Paita is located at approximately 5°N, the other ports are north of Paita.
*** This could have been swordfish taken by a foreign longliner operating with a Peruvian company.
Source: M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 63-202 (1983-92 data) and Dra. Emira Antonieti, Director of Research, IMARPE, personal communications, June 20, 1996 (1993-94 data).

Appendix B3d1.--Peru. Swordfish catch by port, alphabetical order, 1990-95

Port	Year					
	1990	1991	1992	1993	1994	1995
	Metric tons					
Caleta Cruz	Negl	1	1	-	-	-
Callao	-	-	-	Negl	-	6
Ilo	-	-	-	1	303**	1
Máncora	-	Negl	-	-	-	-
Paita	Negl	-	6	-	-	-
Punta Cancas	1	1	Negl	3	6	-
Talara	-	-	7	-	-	-
Zorritos	Negl	1	2	17	1	-
Others	Negl	-	-	-	-	-
Other*	-	-	-	55	-	-
Total	1	3	16	76	310	7

* Factory trawler fleet
** This may have been swordfish caught by associated foreign vessels.
Source: M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 63-202 (1983-92 data); M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1992-94," *Informe*, Nº118 (IMARPE: Callao, April 1996), pp. 35-76 (1992-94 data); Manuel J Flores, Segundo Vera, Raúl Marcelo, and Erika Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana durante 1995," *Informe Progresivo*, Nº45, November 1996, pp. 22-35; and Dra. Emira Antonieti, Director of Research, IMARPE, personal communications, June 20, 1996 and March 13, 1997 (1993-95 data).

Appendix B3d2.--Peru. Swordfish catch by port, geographical order, 1990-95

Region/port	Year					
	1990	1991	1992	1993	1994	1995
	Metric tons					
Northern coast						
Caleta Cruz	Negl	1	1	-	-	-
Zorritos	Negl	1	2	17	1	-
Máncora	-	Negl	-	-	-	-
(Punta) Cancas	1	1	Negl	3	6	-
Talara	-	-	7	-	-	-
Paita**	Negl	-	6	-	-	-
Subtotal, north	1	3	16	20	7	-
Central coast	-	-	-	-	-	
Callao	-	-	-	-	-	6
Southern coast						
Ilo	-	-	-	1	303***	1
Other						
Other ports	Negl	-	-	-	-	-
Factory vessels*	-	-	-	55	-	-
Subtotal, other	Negl	-	-	55	-	-
Total	1	3	16	76	310	7

* Factory trawler fleet
** Paita is located at approximately 5°N, the other ports are north of Paita.
*** This may have been swordfish caught by associated foreign vessels.
Source: M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 63-202 (1983-92 data); M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1992-94," *Informe*, Nº118 (IMARPE: Callao, April 1997), pp. 35-76 (1992-94 data); and Dra. Emira Antonieti, Director of Research, IMARPE, personal communications, June 20, 1996, and March 13, 1997 (1993-95 data).

Appendix B4a.--Peru. Swordfish catch, by month, 1983-95

Year	Month												Total*
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
						Metric tons							
1965													
1966													
1967													
1968	251	301	77	13	14	12	10	17	18	17	4	44	778
1969													
1970													
1971													
1972													
1973													
1974													
1975	7	4	5	57	23	13	1	2	8	13	14	9	158
1976	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	264
1977	52	42	129	79	46	24	12	7	13	2	3	11	420
1978	36	27	32	49	34	24	57	83	22	45	28	9	436
1979	7	6	4	59	19	15	8	6	4	3	19	38	188
1980													
1981													
1982													
1983	86	6	5	3	40	24	2	5	28	3	5	31	238
1984	151	29	4	4	10	23	37	19	11	38	17	-	343
1985	4	17	13	-	-	1	1	-	2	10	7	-	55
1986	Negl	-	4	5	Negl	5	7	-	-	-	Negl	Negl	21
1987	Negl	2	2	19	18	28	Negl	Negl	1	1	1	1	73
1988	1	24	6	1	1	Negl	13	Negl	5	1	1	1	54
1989	Negl	2	Negl	-	Negl	-	-	1	Negl	-	Negl	-	3
1990	-	Negl	Negl	Negl	Negl	-	Negl	-	Negl	Negl	Negl	Negl	1
1991	Negl	1	2	Negl	Negl	Negl	-	-	-	Negl	-	Negl	3
1992	Negl	-	-	Negl	-	-	-	-	3	-	7	6	16
1993	-	5	11	19	5	5	19	1	2	19	-	-	76
1994	Negl	Negl	Negl	1	200#	3	100#	-	1	5	-	-	310
1995	-	Negl	1	-	-	-	Negl	Negl	Negl	1	5	-	7
1996													
Averages**													
1968	251	301	77	13	14	12	10	17	18	17	4	44	778
1970s	26	20	43	61	31	19	20	25	12	16	16	17	293
1980s	35	11	5	5	10	12	9	4	7	8	4	5	112
1990s	Negl	1	2	3	1	1	3	Negl	1	4	2	1	19

* Totals may not agree due to rounding.
** For available years
# This is prbably fish caught by foreign vessels and not included in the averages
Sources: IMARPE, *Informe*, Nº30 and 32 (IMARPE: Callao, various dates) (1968-79 data); Ministerio de Pesqueria, Oficina Sectorial de Planificación, *Anuario Estadístico Pesquero, Peru*, various years (Lima: Ministerio de Pesqueria, December, various years) (1978-79 data); M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 63-202 (1983-92 data); M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1992-94," *Informe*, Nº118 (IMARPE: Callao, April 1996), pp. 23-28 (1982-94 data); Manuel J Flores, Segundo Vera, Raúl Marcelo, and Erika Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana durante 1995," *Informe Progresivo*, Nº45, November 1996, pp. 22-35; and Dra. Emira Antonieti, Director of Research, IMARPE, personal communications, June 20, 1996, and March 13, 1997 (1993-95 data).

Appendix B4b.--Peru. Swordfish catch, by month, 1983-95

Year	Month												Total*
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
						Percentage							
1968	32	39	10	2	2	2	1	2	2	2	1	6	100
1975	4	3	3	36	15	8	1	1	5	8	9	6	100
1976													
1977	12	1	31	19	11	6	3	2	3	Negl	1	3	100
1978	8	6	7	11	8	6	13	19	5	10	6	2	100
1979	4	3	2	31	10	8	4	3	2	2	10	20	100
1983	36	3	2	1	17	10	1	2	12	1	2	13	100
1984	44	8	1	1	3	7	11	6	3	11	5	-	100
1985	7	31	24	-	-	2	2	-	4	18	13	-	100
1986	-	-	19	24	-	24	33	-	-	-	-	-	100
1987	-	1	1	26	25	38	-	-	1	1	1	1	100
1988	2	44	11	2	2	-	24	-	9	2	2	2	100
1989	-	67	-	-	-	-	-	33	-	-	-	-	100
1990	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM
1991	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM
1992	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM	NSM
1993	-	7	14	25	7	7	25	1	2	25	-	-	100
1994#	NSM	NSM	NSM	NSM	NSM#	NSM	NSM#	NSM	NSM	NSM	NSM	NSM	NSM
1995	NSM	NSM	NSM	NSM	NSM#	NSM	NSM#	NSM	NSM	NSM	NSM	NSM	NSM
Averages**													
1968	32	39	10	2	2	2	1	2	2	2	1	6	100
1970s	7	3	11	24	11	7	5	6	4	4	7	10	100
1980s	13	22	8	8	7	12	10	6	4	5	3	2	100
1990s#	Negl	5	11	16	5	5	11	Negl	5	21	11	5	100

NA - Not available
NSM - Not statistically meaningful
* Totals may not agree due to rounding.
** For available years
# Foreign landings excluded
Sources: IMARPE, *Informe*, Nº30 and 32 (IMARPE: Callao, various dates) (1968-79 data); Ministerio de Pesqueria, Oficina Sectorial de Planificación, *Anuario Estadístico Pesquero, Peru*, various years (Lima: Ministerio de Pesqueria, December, various years) (1978-79 data); M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 63-202
(1983-92 data); and and Dra. Emira Antonieti, Director of Research, IMARPE, personal communications, June 20, 1996 and March 13, 1997 (1993-95 data).

Appendix B5a.--Peru. Catch of tuna and related species, longline fleet, 1992-94

Vessels	Operations	Species#				Total
		Tuna*	Billfish**	Sharks	Others***	
		Metric tons				
Japanese fleet	11/92-10/93	1,310	93	548	100	2,501
Maria José	3-11/94	16	11	69	2	98
Taisei Maru 1	10-11/94	44	2	6	Negl	52

Target and associated species
* Target species
** Primarily marlin and swordfish
*** Rays, mantas, turtles, dorado, etc.
Source: Ing. Gladys Liliana Rochafreyre, Directora Nacional de Extracción, Ministerio de Pesqueria, personal communications, Oficio Nº277-96-PE/DNE-Dop, February 7, 1996.

Appendix B5b.--Peru. Shark** and bilfish catch, 1989-95

Year	Sharks**					Total	Billfish*
	Mustelus	Squatina	Rhinobatos	Rajiformes	Elasmobranchii	sharks**	
			Metric tons				
1985	8,764	563	1,413	5,496	546	16,782	-
1986	10,239	1,731	2,046	7,276	1,959	23,251	-
1987	11,137	1,432	1,161	7,922	1,465	12,117	-
1988	13,160	576	3,033	8,251	1,615	26,635	-
1989	12,589	313	715	9,849	1,579	25,045	-
1990	6,458	190	539	4,311	768	12,266	-
1991	2,705	57	218	2,081	525	5,586	-
1992	8,578	93	42	2,771	2,087	13,571	-
1993	8,747	228	89	3,632	1,212	13,908	-
1994	3,431	159	-	1,158	548	5,296	-
1995	4,125	289	121	1,841	694	7,070	-

* IMARPE also does not report any billfish catches.
** Includes rays and skates
Source: FAO. *Yearbook of Fishery statistics*, various years.

Appendix B5c.--Peru. Ray catch, 1983-95

Year	Catch		Total
	Sting	Eagle	
	Metric tons		
1983	1,327	-	1,327
1984	1,803	-	1,803
1985	4,155	-	4,155
1986	6,506	-	6,506
1987	3,259	-	3,259
1988	6,871	-	6,871
1989	8,674	-	8,674
1990	3,226	-	3,226
1991	2,155	-	2,155
1992	498	840	1,338
1993	221	648	869
1994	2,143	787	2,930
1995	233	437	670

Source: M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 23-42 (1983-92 data); M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1992-94," *Informe*, Nº118 (IMARPE: Callao, April 1996), pp. 23-28 (1982-94 data); Manuel J Flores, Segundo Vera, Raúl Marcelo, and Erika Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana durante 1995," *Informe Progresivo*, Nº45, November, 1996, pp. 22-35; and Dra. Emira Antonieti, Director of Research, IMARPE, personal communications, June 20, 1996, and March 13, 1997, p. 18 (1993-95 data).

Appendix B5d.--Korea. Shark and ray catch in the southeastern Pacific*, 1985-95

Year	Catch		Total
	Rajiformes	Elasmobranchii	
	Metric tons		
1985	-	-	-
1986	-	-	-
1987	-	-	-
1988	-	-	-
1989	356	-	356
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	668	-	668
1994	120	-	120
1995	-	-	-

* FAO area 87.
Source: FAO. *Yearbook of Fishery Statistics*, 1994.

Appendix B5e.--Japan. Shark and ray catch in the southeastern Pacific*, 1985-95

Year	Catch		Total
	Rajiformes	Elasmobranchii	
	Metric tons		
1985	-	521	521
1986	-	663	663
1987	-	1,754	1,754
1988	-	1,297	1,297
1989	-	818	818
1990	-	1,409	1,409
1991	-	857	857
1992	-	1,032	1,032
1993	-	996	996
1994	-	1,415	1,415
1995	-	492	492

* FAO area 87
Source: FAO. *Yearbook of Fishery Statistics*, 1994.

Appendix B5f.--Ecuador and Peru. Turtle catch, 1985-95

Year	Catch	
	Ecuador	Peru
	Metric tons	
1985	124	36
1986	715	9
1987	-	305
1988	-	32
1989	-	79
1990	-	101
1991	-	9
1992	-	30
1993	-	28
1994	-	6
1995	10	4

Source: FAO, *Yearbook of Fishery Statistics*, 1994.

Appendix B5g.--Peru. Pinniped census, 1968-96

Year	Species		Total
	Sea lion	Fur seal	
	Number		
1968	17,400	11,800	29,200
1971	22,800	7,300	30,100
1974	20,000	10,200	30,200
1975	19,800	NA	NA
1977	18,900	15,800	28,100
1978	25,000	21,700	46,700
1984	33,800	15,400	49,200
1996	NA	NA	120,000E

E - Unknown estimate reported in the press.
Source: IMARPE census data reported by Jorge Mehía Gallegos, "La pesca aretesanal y los lobos marinos," *Pesca*, July-August, 1989, p. 10 (1968-84 data) and "Plea for sea lion cull in Peru," *Seafood International*, April 1997 (1996 data).

Appendix B6.--Soviet Union/Russia. Swordfish catch by FAO area, 1970-95

Year	FAO Area*				Total
	34	47	51	87	
	Metric tons				
1970	200	-	-	-	200
1971	200	-	-	-	200
1972	200	-	-	-	200
1973	200	-	Negl	-	200
1974	1,400	-	Negl	-	1,400
1975	263	-	23	-	286
1976	157	-	-	-	157
1977	87	34	2	-	123
1978	146	37	-	-	183
1979	58	22	-	-	80
1980	140	35	-	-	175
1981	36	4	-	-	40
1982	90	5	-	-	95
1983	46	-	-	-**	46
1984	162	12	-	-**	174
1985	73	-	-	-**	73
1986	18	-	-	-	18
1987	4	-	-	-	4
1988	-	-	-	-	-
1989	-	-	-	-	-
1990	-	-	-	-	-
1991	-	-	-	-	-
1992	-	-	-	-	-
1993	-#	-	-	-***	-
1994	-	-	-	-	-
1995	-	-	-	-	-

* FAO Areas:
34 - Centraleastern Atlantic (off West Africa)
41 - Southeastern Atlantic
51 - Eastern Indian Ocean
87 - Southeastern Pacific

** Peruvian officials reported that the Soviet stern factory trawlers operating with Peru's 200-mile zone took swordfish incidentally (appendix B3c2?), Such incidental catches could have been taken prior to 1983, but the authors do not have a complete set of Peruvian statistical reports. No information is available on possible incidental swordfish catches outside of 200 miles, but the Soviets reported none to FAO.

*** Peruvian officials also reported a catch by factory trawlers in 1993 (appendix B3d1). The large Soviet stern factory trawlers were no longer operating off Peru, but a joint venture was operating several small Russian-built trawlers in 1993. For details see the Peruvian chapter of Weidner and Hall, "Latin America," *World Fishing Fleets*, Vol. IV (NMFS: Silver Spring, Maryland, 1993).

Lithuania, a former Soviet republic reported a 794 t swordfish catch off West Africa in 1994.

Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix B7a--Catch trends of prey species, 1983-92

Year/ species	Month												Total*
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	1,000 Metric tons												
1983													
J. mackerel	0.5	0.2	0.1	0.2	0.3	3.5	2.5	12.4	7.6	9.7	11.9	11.8	60.8
Squid	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	0.2
Giant squid	-	-	-	-	-	-	-	-	-	-	-	-	-
1984													
J. mackerel	6.6	7.0	5.7	10.9	22.5	15.2	15.2	11.8	5.3	5.3	30.6	36.1	172.1
Squid	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	0.1
Giant squid	Negl	Negl	-	-	Negl	-	-	-	-	-	Negl	Negl	Negl
1985													
J. mackerel	5.8	9.0	3.6	11.1	7.7	9.3	10.5	3.7	1.0	2.7	2.9	1.3	68.6
Squid	Negl	Negl	0.1	Negl	Negl	Negl	Negl	Negl	0.1	Negl	Negl	Negl	0.4
Giant squid	Negl	0.1	Negl	Negl	-	-	-	-	-	-	-	Negl	0.2
1986													
J. mackerel	3.0	3.7	4.3	3.5	6.2	6.8	5.3	3.9	3.1	2.8	1.8	2.4	47.0
Squid	Negl	Negl	Negl	Negl	0.1	0.1	0.1	Negl	0.1	Negl	Negl	0.1	0.7
Giant squid	Negl	Negl	Negl	Negl	Negl	Negl	Negl	0.2	0.2	0.2	0.1	Negl	0.7
1987													
J. mackerel	2.9	1.9	2.3	2.3	2.9	3.0	0.8	1.4	0.3	2.5	4.6	4.8	29.7
Squid	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	0.2
Giant squid	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl
1988													
J. mackerel	6.8	10.8	14.0	12.4	9.9	8.7	9.0	5.3	8.5	7.6	8.9	7.6	109.6
Squid	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	0.2
Giant squid	-	Negl	Negl	Negl	Negl	0.1	0.1	Negl	0.1	Negl	Negl	0.1	0.4
1989													
J. mackerel	6.9	7.1	8.6	8.9	12.6	15.4	20.0	10.9	9.4	10.5	9.9	11.2	131.5
Squid	Negl	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0
Giant squid	0.1	Negl	Negl	Negl	0.2	0.2	0.1	0.1	0.2	Negl	Negl	0.1	1.0
1990													
J. mackerel	17.8	16.4	17.7	17.6	14.0	8.4	16.2	15.3	9.1	6.0	9.5	13.8	160.8
Squid	0.1	0.1	0.4	0.8	0.5	0.1	Negl	0.5	1.1	Negl	Negl	Negl	3.7
Giant squid	0.3	0.4	0.6	0.3	0.5	1.2	0.6	0.4	0.4	0.1	0.1	2.0	6.9
1991													
J. mackerel	19.9	6.1	15.1	21.5	8.7	9.2	9.6	1.6	16.6	12.0	5.4	10.8	136.6
Squid	0.1	0.3	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	0.1	Negl	0.7
Giant squid	0.9	7.7	2.8	3.4	3.6	7.9	9.3	6.2	6.3	11.7	9.2	8.5	77.6
1992													
J. mackerel	5.6	1.7	0.8	0.4	0.8	5.9	6.2	3.0	2.9	2.3	7.9	13.6	51.2
Squid	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	0.1	Negl	0.2
Giant squid	5.2	4.7	2.4	2.6	2.6	7.7	10.0	8.9	16.2	12.2	15.6	19.4	107.1
1993													
J. mackerel	4.8	2.5	4.3	5.2	12.9	3.1	0.4	1.3	2.7	4.5	14.0	8.7	64.5
Squid	9.0	0.3	0.1	0.3	3.5	24.6	38.6	31.4	8.7	11.3	5.3	7.1	140.3
Giant squid	0.1	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	Negl	0.2	0.1	0.2
1994													
J. mackerel	19.8	9.5	38.6	5.0	4.3	18.8	10.3	6.0	3.9	7.5	13.8	13.9	151.3
Squid	2.5	1.3	1.3	2.1	2.0	40.9	54.8	19.5	27.4	17.1	12.8	7.2	188.8
Giant squid	0.1	Negl	Negl	0.1	Negl	Negl	Negl	0.1	Negl	Negl	0.2	0.1	0.4
1995													
J. mackerel	36.1	13.3	30.5	38.4	29.9	24.6	42.6	5.9	18.6	17.1	15.4	34.6	307.0
Squid	2.5	0.4	1.2	1.9	2.6	10.5	21.4	15.2	15.1	8.9	10.9	1.8	92.4
Giant squid	Negl	Negl	Negl	Negl	0.4	0.7	0.9	0.8	0.7	0.2	0.5	0.1	4.4

Species:
Jack mackerel - jurel (*Trachurus picturatus murphyi*)
Squid - calamar (*Thais chocolata*)
Giant squid - pota (*Dosidicus gigas*)

Source: M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 23-42; M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1992-94," *Informe*, Nº118 (IMARPE: Callao, April 1996), pp. 25-28; Manuel J Flores, Segundo Vera, Raúl Marcelo, and Erika Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana durante 1995," *Informe Progresivo*, Nº45, November 1996, pp. 18-19.

Appendix B7b1.--Peru. Landings of prey species, by port, 1992

Port	1992		
	J. mackerel	Squid	G. squid
		Metric tons	
Northern coast			
Puerto Pizarro	-	-	25
Caleta Cruz	-	1,105	61
Zorritos	3	253	10
Acapulco	-	-	-
Punta Mero	-	-	-
(Punta) Cancas	21	-	-
Máncora	15	-	-
(Los) Organos	70	-	-
(El) Ñuro	66	-	-
Cabo Blanco	43	-	-
Lobitos	57	-	-
Talara	18	1,709	-
Negritos	21	74	-
Paita	17,267	152	42
Parachique	11,176	Negl	47
Subtotal, north	28,757	3,293	185
Central coast			
San José	1,694	1	-
Pimentel	6	Negl	-
Santa Rosa	1,072	-	-
Pacasmayo	4	-	-
Salaverry	419	-	-
Coishco	2,192	-	-
Chimbote	11,754	-	29
Supe	23	-	-
Huacho	1,209	-	-
Chancay	9	-	-
Callao	127	15	-
Callao-TPZ	443	-	-
Pisco	34	27	-
Subtotal, central	18,986	43	29
Southern coast			
San Adrés	21	1	-
Lomas	5	-	-
Chala	2	-	-
Atico	3	-	-
Camaná	12	-	-
Mollendo	1,810	Negl	13
Ilo	1,265	7	-
Vila Vila	-	9	1
Subtotal, south	3,118	17	14
Other			
Factory vessels			
Trawlers	295	7	-
Jiggers	-	103,784*	-
Subtotal, other	295	103,791	-
Total	51,156	107,144	228

Note: Given the limited range of much of the Peruvian fleet, the landing site for the domestic fleet is a good general indicator of where the fish/squid was caught.
* The giant squid catch is primarily landed by foreign (Japanese and Korean) jiggers which purchase Peruvian licenses. Landings data is not available, but the authors believe that most of the catch is taken off the northern coast.
Source: M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1983-92," *Informe*, Nº105 (IMARPE: Callao, March 1994), pp. 189-202.

Appendix B7b2.--Peru. Landings of prey species, by port, 1994

Port	1994		
	J. mackerel	Squid	G. squid
		Metric tons	
Northern coast			
Puerto Pizarro	Negl	-	101
Caleta Cruz	-	90	-
Zorritos	121	121	-
Acapulco	1	2,763	-
Punta Mero	24	35	-
(Punta) Cancas	-	1,542	-
Máncora	-	-	-
(Los) Organos	-	-	-
(El) Ñuro	-	-	-
Cabo Blanco	-	-	-
Lobitos	-	-	-
Talara	6,116	11,306	-
Negritos	-	-	1
Paita	91,238	7,900	-
Parachique	2,144	-	-
Subtotal, north	97,500	23,757	102
Central coast			
San José	Negl	Negl	-
Pimentel	26	Negl	Negl
Santa Rosa	3,865	5	-
Pacasmayo	-	1	-
Salaverry	3,058	102	Negl
Coishco	638	-	-
Chimbote	38,699	212	110
Casma	1	-	29
Huarmey	-	-	18
Supe	31	-	-
Huacho	1,209	-	104
Chancay	-	-	-
Callao	9	19	-
Callao-TPZ	485	3	-
Pisco	15	110	-
Subtotal, central	48,036	452	261
Southern coast			
San Adrés	27	Negl	Negl
Lomas	-	-	-
Chala	-	-	-
Atico	-	-	-
Camaná	-	-	-
Mollendo	330	Negl	Negl
Ilo	1,846	-	-
Vila Vila	101	-	-
Subtotal, south	2,304	Negl	Negl
Other			
Factory vessels			
Trawlers	-	-	-
Jiggers	-	164,713	- *
Subtotal, other	-	164,713	-
Total	151,349	188,801	363

Note: Given the limited range of much of the Peruvian fleet, the landing site for the domestic fleet is a good general indicator of where the fish/squid was caught.
* The giant squid catch is primarily landed by foreign (Japanese and Korean) jiggers which purchase Peruvian licenses. Landings data is not available, but the authors believe that most of the catch is taken off the northern coast.
Source: M. Flores, S. Vera, R. Marcelo, and E. Chirinos, "Estadísticas de los desembarques de la pesquería marina peruana, 1992-94," *Informe*, Nº118 (IMARPE: Callao, April 1996), pp. 63-768.m

Appendix B8a1.--Peru. Vessel trip reports: *Pionero*, July 1997

Set	Date	Position		Temperature	Swordfish catch			
		South	West		Individuals	Quantity	Range	Average
		°S	°W	°C	Number	Kilograms (H&G)		
1	July 10	19	77	21.1	1	60	60	60
2	July 11	19	77	20.6-21.1	4	105	15-40	26
3	July 12	19	77	21.3	1	20	20	20
4	July 13	NA	NA	NA	8	NA	NA	NA
5	July 14	19	78	20.8-21.0	4	160	30-50	40
6	July 15	NA	NA	NA	2	NA	NA	NA
7	July 16	18	78	21.5-21.9	12	270	15-40	23
8	July 17	18	78	20.6-22.4	20	485	15-50	24
9	July 18	18	78	21.0-22.5	12	440	15-80	37
Total					66	2,014*		31

Location: The position is off the southern coast close to the Chilean marine border, about 600-700 km off Ilo.
Bait: Horse mackerel
Note: A subsequent trial during August yielded very poor results (only one 30-km swordfish) in sets off northern Peru, about 300-km off the coast.
* Estimated at 1,770 kg onboard.
Source: Ramon Salas, SIPESCA, personal communications, August 26 and September 1, 1997.

Appendix B8a2.--Peru. Vessel trip reports: *Pionero*, July 1997

Species	Landings	
	Individuals	Quantity
	Number	Kilograms (H&G)
Swordfish	66	2,014
Shark		
Blue*	357	5,672
Mako	26	361
Tuna (yellowfin)	4	131

Note: The position is off the southern coast close to the Chilean marine border, about 700 km off Ilo.
* This species apparently does a lot of damag to the gear as well as damages hooked swordfish which then have gto be discarded because they have no commercial value. (The discarded trunks are not counted in the catch.)
Source: Ramon Salas, SIPESCA, personal communications, August 26, 1997.

Appendix B8b.--Peru. Vessel trip reports: *Christopher Atlantis*, May-June 1997

Zone	Sets	Position		Temperature	Swordfish catch			
		South	West		Individuals	Quantity	Range	Average
		°S	°W	°C	Number	Kilograms (H&G)		
1	NA	18	75	18.5	NA	NA	NA	NA
2	NA	18	75	20.9	NA	NA	NA	NA
Total	11				7	220*	NA	31

Note: The position is off the southern coast close to the Chilean marine border, about 400 km off Ilo.
Bait: Squid
Dates: May 25-June 16, 1997
* 220 kg live weight.
Source: Ramon Salas, SIPESCA, personal communications, August 26, 1997.

Appendix C1.--Peru. Swordfish processing and export

Year	Catch#	Processed		Exports	
		Fresh	Frozen	Quantity	Value
		Metric tons			S/1,000
1967	1,273.8	NA	NA	183.6*	6,456
1968	778.1	NA	198.5**	336.8*	7,212
1969	1,162.0	200.3	961.7		
1979	38.0	33.6	4.4		

Data may be landed weight, which would make the actual catch about 30 percent greater. Discrepancies with catch tables above are unexplained.
* Frozen
** Landings at Caleta Cruz and Paita.
Source: IMARPE, *Informe*, N°30 and 32 (IMARPE: Callao, different dates) (1967-69 data) and Ministerio de Pesqueria, Oficina Sectorial de Planificación, *Anuario Estadístico Pesquero, Peru-1979* (Lima: Ministerio de Pesqueria, December, 1981) (1979 data).

Appendix C2.--Peru. Swordfish marketed in the Lima fisheries market, 1965-74

Year	Quantity
	Metric tons
1965	-
1966	-
1967	-
1968	-
1969	0.7
1970	-
1971	112.2
1972	135.0
1973	591.6
1974	153.7

Source: Ministerio de Pesqueria, Oficina Sectorial de Planificación, *Anuario Estadístico Pesquero, Peru*, various years (Lima: Ministerio de Pesqueria, December, various years)

Appendix C3.--Peru. Shark processing, 1990-94

Year	Product form			Total
	Fresh	Frozen	Cured	
	Metric tons			
1990	584	157	27	768
1991	205	315	32	552
1992	1,304	762	21	2,087
1993	132	808	3	943
1994	12	301	2	315

Source: INFOPESCA, "Peru: Producción anual de tiburon, segun procesamiento, años 1990-1994," *Noticias Comerciales*, December 20, 1995.

Appendix D.--Peru. Government agencies and companies involved with oceanic pelagics

Government Agencies

Ministerio de Pesqueria (MIPE)
Paseo de la Republica #3103
Lima
PERU
FAX: (51-14) 703-978
Tel: (51-1) 224-3283
224-2950

Capitania de Puertos
Callao: (51-1) 429-0109
Ilo: (51-5) 478-1767 or 478-1659

Research Institutes/Universities

Instituto del Mar del Peru (IMARPE)
Apartado 22
Callao, PERU
Tel: (51-14) 429-7030/7630??
FAX: 656-023

Instituto Tecnologico Pesquero (ITP)
Carretera Ventinilla, Km. 5.2
Callao
PERU
Tel: (51-14) 219-181
FAX: 512-181

Universidad de Piura
Nicolás de Rivera 135
San Isidro, Lima 27
PERU
Tel: (51-74) 32-8171 (Piura)
FAX: (51-74) 32-8645 (Piura)

Felix Dávila Gil
Programa de Ictiología Pesquera
Universidad de Trujillo
Trujillo
PERU

Jaime Espinoza
Programa de Ingeniería Pesquera
Universidad Nacional Técnica del Callao
Callao
PERU

Environmental Organization

Asociación de Ecología y Consevación
Vanderghen 560 #2A
Lima 27
PERU

Trade Associations

Sociedad Nacional de Pesqueria (SNP)
Los Laureles 381
San Isidro
PERU
Tel: (51-1) 441-8345, 442-7180
FAX: (51-1) 442-7190

Genaro Huamanchumo, Presidente
Asociación de Armadores de Consumo Directo del Perú
address unknown

Sociedad de Nuevas Embarcaciones Pesqueras
Andrés Reyes 466
San Isidro
Lima 27
PERU
Tel: (51-1) 440-8617
FAX: 441-7714

Sociedad Nacional de Armadores Pesqueros
Calle veinteocho 145
Urb. Córpac
San Isidro
Lima 27
PERU
Tel: (51-1) 476-3338, 475-4710
FAX: 476-3338

Universidad Villareal
address unknown

Centro de Entrenamiento Pesquero-Paita
Playa Hermoza s/n
Paita, Piura
PERU
Tel: (51-74) 611-454
FAX: 611-397

Corporación Nacional de Armadores Pesqueros
Av. Guardía Civil 836 Urb. Corpac
San Isidro
Lima, PERU
Tel: 40-7237
FAX: 41-9033

Comité de Pesca
Asociación de Exportadores (ADEX)
Av. Las Palmeras 375
San Isidro
Lima 27, PERU
Tel: (51-1) 346-2530
FAX: (51-1) 346-1879

Companies

Abastecimientos Marinos
Calle Cartavio 109
Urb. Monterrico
Santiago de Surco
Lima 13
PERU
Tel: (511) 435-6773
FAX: 435-6773

Agro-Pesca
Diego Ferré
Lima 18, PERU
Tel: (51-1) 444-0367
FAX: (51-1) 447-6517

Consorcio Pesquero S.A.
Calle Carpaccio 296
5to Piso
San Borja
Lima 41
PERU
Tel: (51-1)-475-0777/750-777
Fax: (51-1)-475-5193

Gloria
República de Panamá 2461
Santa Catalina la Victoria
Lima 13
PERU
Tel: (511) 470-7170
FAX: 470-9387

Grupo Sotomayor
Calle Carpaccio 296, Piso 5
San Borja
Lima 41
PERU
Tel: (511) 475-0777; 475-8577
FAX: 475-5193

IBC
Las Begonias 552, Of. 4
San Isidro
Lima
PERU
Tel: (51-14) 417-588
FAX: 410-880

Industrias Pesqueras Daruma, S.A.
Av. Pedro de Osma 328, Of. 101-A
Barranco
Lima 4
PERU
Tel: 467-4222; 4215
FAX: 467-4219

Luming
Alborada 1426
Urb. las Brisas
Pueblo Libre
Lima 21
PERU
Tel: (511) 463-9282
FAX: 463-9282

(R.) Muelle, S.A.
Jr. Miller 450, Oficina 603
Callao PERU
Tel: (51-14) 296-606
FAX: 655-529

Pesquera Atlantis
address unknown

Productos Pesquero Peruano
address unknown

Refrigerados Iny
Las Begonias 552, Piso 3, Of. 45
San Isidro
Lima 27
PERU
Tel: (511) 442-2442; 2722
FAX: 442-3260

Sindicato Pesquero
address unknown
Tel: (51-1) 221-3066

TRAMARSA
Giron Matara 340
Ilo
PERU
Tel: (51-5) 478-1682
FAX: (51-5) 478-2295

Tuna Latin
Andulucia 174
Miraflores
Lima
PERU
Tel: (51-1) 422-6574
FAX: 422-4701

Trade Journals

Pesca
Apt. 877
Lima 1
PERU
Tel: 46-4383

Shipyards

Gerente de Producción
Naves Industriales (NAVINSA)
Casilla Postal 186
Callao 01
PERU
Tel: (51-1) 429-5450, 5459
FAX: (51-1) 465-1060

Construcciones A. Maggiolo
Av. Jorge Chávez 148
Apt. 01-309
Callao 1
PERU
Tel: 295-310; 296-637
FAX: 295-190
Tel: 429-6633; 429-5310
FAX: 429-5190

Sport Fishing

Ursino Gonzalez
Hostal El Merlin
Cabo Blanco
Piura 1
Talara, El Alto
Tel: (51-74) 85-6188
FAX: 32-0210

Carol Zegarra
PROMPERU
Internet: CAROL@foptur.gob.pe

Appendix E1.--Peru. Fishery exports, 1985-95

Year	Reduction		Other	Total	Proportion
	Meal	Oil	(Edible)		edible
	US$ Million				Percent
1985	118.1	8.3	95.2	221.6	43
1986	200.1	9.8	48.2	258.1	19
1987	222.0	0.2	65.3	287.5	23
1988	346.9	0.2	55.3	402.4	14
1989	406.5	15.2	57.3	479.0	12
1990	346.7	4.3	48.7	399.7	12
1991	437.5	5.6	55.7	498.8	11
1992	451.7	7.8	57.6	517.1	11
1993	560.4	35.5	89.1	685.0	13
1994	743.3	67.5	168.7	979.5	17
1995	696.9	61.4	111.4	869.7	13

Source: FAO, *Yearbook of Fishery Statistics*, various years.

Appendix E2.--World. Swordfish imports from Peru, 1990-95

Country	Year						
	1990	1991	1992	1993	1994	1995	1996
	Metric tons						
European Union	NA	-	155	31	Negl	25	
Japan	-	-	-	-	8E	4E	2E
United States	-	5	-	-	Negl	-	Negl
Other*	NA	NA	NA	NA	NA	NA	
Total	-	5	155	31	8	29	

* Believed to be negligible
E - NMFS estimate. See appendix E4a.
Source: EU, Eurostat; Japan Tariff Association, and U.S. Bureau of the Census.

Appendix E2a1.--United States. Swordfish imports from Peru, 1980-96

Year	Commodity		Total
	Fresh	Frozen	
	Metric tons		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	10.6	10.6
1979	-	4.0	4.0
1980	-	6.6	6.6
1981	-	9.1	9.1
1982	-	6.2	6.2
1983	-	-	-
1984	-	1.6	1.6
1985	1.8	-	1.8
1986	1.0	9.5	10.5
1987	-	1.1	1.1
1988	2.2	1.2	3.4
1989	11.0	-	11.0
1990	-	-	-
1991	5.0	-	5.0
1992	-	-	-
1993	-	-	-
1994	0.4	-	0.4
1995	-	-	-
1996	0.4	-	0.4

Source: U.S. Bureau of the Census.

Appendix E2a2.--United States. Swordfish imports from Peru, 1980-96

Year	Commodity		Total
	Fresh	Frozen	
	U.S.$1,000		
1975	-	-	-
1976	-	-	-
1977	-	-	-
1978	-	22	22
1979	-	9	9
1980	-	22	22
1981	-	24	24
1982	-	28	28
1983	-	-	-
1984	-	9	9
1985	30	-	30
1986	1	16	17
1987	-	5	5
1988	14	3	17
1989	78	-	78
1990	-	-	-
1991	39	-	39
1992	-	-	-
1993	-	-	-
1994	3	-	3
1995	-	-	-
1996	5	-	5

Source: U.S. Bureau of the Census

Appendix E2b.--United States. Fishery imports from Peru, by product form, 1990-96

Product form	Year						
	1990	1991	1992	1993	1994	1995	1996
	US$ Million						
Live	-	-	Negl	-	-	-	Negl
Fresh	0.1	Negl	0.1	0.2	0.6	1.0	2.9
Frozen	23.0	19.7	23.1	20.7	28.7	32.5	23.7
Canned	3.5	3.0	0.7	1.9	3.4	3.0	1.3
Curred	-	-	-	-	-	Negl	-
Other	7.4	6.2	8.9	8.1	8.3	16.8	11.0
Total	34.0	28.9	32.7	30.9	41.0	53.3	38.9

Source: U.S. Bureau of the Census.

Appendix E2c.--United States. Fresh imports of oceanic pelagics from Peru, 1994-96

Species/ form	Year						
	1990	1991	1992	1993	1994	1995	1996
				US$ 1,000			
Shark							
Dogfish	-	-	3.2	-	38.2	-	-
Other	-	-	-	-	-	6.3	-
Swordfish	-	38.7	-	-	2.5	-	4.9
Tuna							
Albaore	-	2.8	-	2.3	-	-	-
Yellowfin	-	3.6	-	-	15.8	-	30.4
Other	-	-	3.1	2.4	132.1	-	15.3
Total	-	45.1	6.3	4.7	188.5	6.3	50.6

Source: U.S. Bureau of the Census.

Appendix E3.--European Union. Swordfish imports from Peru, 1991-95

Country	Commodity	Years				
		1991	1992	1993	1994	1995
				Metric tons		
France	Frozen fillets	NA	-	-	-	25
Germany	Frozen trunks	NA	-	11	-	-
Spain	Frozen trunks	NA	155	20	Negl	-
Total		NA	155	31	Negl	25

NA - Not available
Source: EU. Eurostat.

Appendix E4a.--Japan. Billfish (including swordfish) imports from Peru, 1986-94

Year	Quantity	
	Billfish	Swordfish
	Metric tons	
1986	-	-
1987	4	1E
1988	-	-
1989	2	1E
1990	-	-
1991	-	-
1992	-	-
1993	-	-
1994	24	8E
1995	12	4E
1996	5	2E

E - Estimated swordfish proportion of billfish imports
Source: Japan Tariff Association,
Japan Exports & Imports, various years.

Appendix E4b.--Japan. Billfish (including swordfish) imports from Peru, 1986-96

Year	Product form			Total*
	Fresh	Frozen		
		Fillets	Other	
	Metric tons			
1986	-	-	-	-
1987	-	1**	3	4
1988	-	-	-	-
1989	-	-	2	2
1990	-	-	-	-
1991	-	-	-	-
1992	-	-	-	-
1993	-	-	-	-
1994	-	-	24	24
1995	Negl	-	11	12
1996	1	2	2	5

* Totals may not agree due to rounding.
** Until 1993 the fillets category included some tuna fillets.
Source: Japan Tariff Association, *Japan Exports & Imports*, various years.

Appendix F.--Peru. Contracts aboard Tuna Latin vessels

Company/ crew	Share*
	Percent
Company	65
Crew	
Fishing master	6-7
Captain	4
First mate	3
Second mate	2
Crew	1.0-1.5**
	35

* Shares of the net profits
** Depending on length of service.
Source: Maximo Collao, Tuna Latin, personal communications, June 27, 1996.

Appendix G1.--Peru. Tuna licenses, 1994

Country	Vessel
Japan	
	Kiko Maru No. 1
	Koei Maru No. 18
	Zenko Maru No. 1
	Zenko Maru No. 26
	Zenko Maru No. 38
	Zenko Maru No. 51
Other countries	
	NA

Note: Licenses vaid for 6 months.
NA - Not available, but belived to be very limited.
Source: R.M. 121-94-PE, March 21, 1995

Appendix G2.--Peru. Tuna longline and purse seine vessels licensed, 1993-95

Vessel type	Country/ vessel	Size		Capacity		Licenses	Peruvian company*
		Gross	Net	Hold	Freezer		
		GRT	NRT	Tons	T/day		
Longliners							
	Japan						
	Kiko Maru No. 18	359	178	218	16	1/15/93-8/22/93	Tuna Latin
						8/23/93-10/14/93	Tuna Latin
	Kiku Maru 16	315	155	180	8	1/15/93-7/15/93	Tuna Latin
						8/16/93-10/15/93	Tuna Latin
	Taisei Maru 1	349	200	557	28	10/94-to date	NA
	Zenko Maru No. 1	701	296	300	18	11/1/92-2/13/93	Tuna Latin
						2/21/93-7/8/93	Tuna Latin
						7/13/93-10/93	Tuna Latin
	Zenko Maru No. 26	344	173	190	6	11/1/92-4/30/93	Tuna Latin
						5/1/93-10/12/93	Tuna Latin
	Zenko Maru No. 38	619	257	285	8	2/20/93-4/13/93	Tuna Latin
						4/14/93-10/93	Tuna Latin
	Zenko Maru No. 51	315	160	190	8	11/1/92-4/30/93	Tuna Latin
						5/1/93-12/10/93	Tuna Latin
	Peru						
	María José	69	25	54	6	3/94-9/95	Consorcio Pesquero
Purse seiners							
	United States						
	Connie Jean	496	208	400	NA	1/23/95-6/22/95	NA

NA - Not available
*
Source: Ing. Jorge Zuzunaga Zuzunaga, Director Ejecutivo, Instituto del Mar, personal communications, Of. NºDE-300-133-96-PE/IMP, February 26, 1996 and Máximo Collao, General Manager and Co-Owner, Tuna Latin, personal communications, June 27, 1996.

Appendix G3.--Peru. Tuna licenses, 1992-95

Year	Country			Total	Type
	Peru	Japan	U.S.		
		Number			
1992	-	6	-	6	Longline
1993	-	6	-	6	Longline
1994	1	1	-	2	Longline
1995	2	1	1*	4	Longline/Purseseine
1996	NA	NA	NA	5	Longliners
1997					

Note: Discrepancies with appendices G1-2 are unexplained.
* The U.S. license was for a purseseiner doing test fishing.
Source: Ing. Gladys Liliana Rochafreyre, Directora Nacional de Extracción, Ministerio de Pesqueria, personal communications, Oficio Nº277-96-PE/DNE-Dop, February 7, 1996 (1992-95 data) and Jorge Campos, Manager, Productos Pesquero Peruano, personal communications, May 28, 1997 (1996 data).

Appendix H.--Peru. Glossary of oceanic pelagics

Common		Scientific
Spanish	English	
Atun	Tuna	Thunnus sp.
Albacora	Albacore	T. alalunga
Aleta azul	Bluefin	T. thynnus orientalis
Aleta amarilla	Yellowfin	T. albacares
Barrilete	Skipjack	Katsuwanus pelamia
Ojo grande	Bigeye	T. obesus
Cachorreta	Oceanic bonito	????
Dorado	Dolphin/mahi-mahi	Coryphaena hippurus
Gallo	Rooster fish	Nematistius pectoralis
Macarela	Mackerel	Auxis sp.
Barrilete	Bullet	A. rochei
Barrilete negro	Frigate	A. thazard
Marlín	See "Pez aguja"	
Perico	See "Dorado"	
Pez aguja	Billfish	
Marlín azul	Indo-Pacific blue marlin	Makaira mazara
Marlín negro	Black marlin	M. indica
Marlín rayado	Stripped marlin	Tetrapturus audax
Pez vela	Indo-Pacific sailfish	Istiophorus platypterus
Pez espada	Swordfish	Xiphias gladius
Pez gallo: See gallo		
Quella	NA	NA
Rayas	Rays	
Raya	Sting	Urotrygon spp.
Raya águila	Eagle	Myliobatis peruvians
Tiburones*	Sharks*	Carcharhinus sp. and others
Aleta	Soupfin	Galeorhinus zyopterus
Angelote	Angel	Squatina armata
Azul	Blue	Prionace glauca
Blanco	Speckled smoothound	Mustelus mento
Cazon/tiburón	Silky	Carcharhinus falciformis
Cazon	Galapagos	C. galapagensis
Cazon	Black tip	C. limbatus
Cazon	Oceanic whitetip	C. longlinanus
Cruz/amarillo	Smooth hammerhead	Sphyrna zygaena
Diamente/bonito	Shortfin mako	Isurus oxyrinchus
Gatita	Broadnose sevengill	Notorynchus cepedianus
Gato	Bullhead	Heterodontus quoyi
Guitara	Guitar	Rhinobatos planiceps
Martillo	Hammarhead	Sphyrna zygaena
Tintorera/azul	Blue	Prionace glauca
Zorro	Threasher	Alopias vulpinus
Tollos	Sharks/dogfish (See "tiburones")	Mustelus sp. and others
Común	Sicklefin smoothound	Mustelus lunulatus
Gato	Unknown	Schroederichthys chiliensis
Manchado	Spotted houndshark	Triakis maculata
Tollo	Humpback smoothound	M. whitneyi
Tortugas/quelonios	Turtles	
Verde	Green	Chelonia mydas
Quillada	Leatherback	Dermochelys coriacea
Caret	Hawksbill	Eretmochelys imbricata
Loro	Olive Ridley	Lepidochelys olivacea
Caguama	Loggerhead	Caretta caretta
Vidrios/lubinas	Sea basses	NA

NA - Not available
* and related species such as guitar fish
Source: Various.

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